THE

AMERICAN NATURALIST.

VOL. XX.—*OCTOBER*, 1886.—No. 10.

SOME DEITIES AND DEMONS OF THE NAVAJOS.

BY DR. W. MATTHEWS, U. S. ARMY.

THE great dry-paintings of the Navajo priests, which I described in a previous number of this journal (October, 1885), illustrate, as I then explained, the visions of the prophets. But the prophets saw the gods in their visions, hence the paintings contain pictures of the gods with all their hieratic belongings. The characters which perform in the great dances conducted by the priests, are representatives of the gods. In the ancient creation-myth of the tribe some descriptions of the gods are incidentally given. In the later myths, recounting the acts of the prophets, more exact descriptions are to be found. It is from such material as this—these oral traditions, these paintings, these ceremonies, with their hundreds of songs and elaborate unchangeable rituals, handed down from generation to generation by word of mouth and by example only—that the student must evolve the nature and scope of their worship.

In one of the great ceremonies, that of the *Kledji Hathal*, or *Gaybechy*, there are, according to the circumstances, from twelve to sixteen different supernatural characters represented. Some of these, like the *gaybaäd*, being a numerous race of divine ones, are represented by many dancers—men masked, dressed and painted to represent gods, bearing sacred wands and talismans and symbolizing in every act and motion something in the lives of their prototypes; living and breathing idols to whom the suppliant prays and offers his sacrifices, well knowing that he addresses with reverent prayers only his own brother or uncle masquerading in the panoply of divinity.

They begin their cosmogony with an already existing world. It is a dim world; there is light, but as yet no sun, moon or stars. It is inhabited, however, by animals or animal gods with the gift of speech and other human attributes, and by some vague gods, probably meteorological personifications, possessing more of the human than the animal character. Just when mortal man first appears on the stage it is difficult or impossible to determine. True there is a first man and a first woman, as there seem to be in nearly all Indian myths; but they do not appear as the progenitors of the race. The time of their beginning is not told, they are coeval with the universe, and they still live in distant lands, but not in the nether world where dead Navajos go; in short, they are immortal and eternal—they are gods. Perhaps we have in them but an extension of the zoölatry of the Indian; as the lower animals have their ancient divine prototypes, so man must have his. With a strange suggestion of the existence of a primeval Darwin, we find in the legend the animals assuming more and more the human character, until the lower worlds which were once peopled only by flying animals are later inhabited by creatures who are spoken of as men. All the beings in the first world are able to fly away on wings from the rising waters of the flood; while in the third and fourth worlds they are obliged to seek protection in the hollow of a great reed, which grows as fast as the rising waters advance and bears the fugitives upward out of danger.

Arrived on this, the fifth, world, men increased and multiplied; but soon various enemies to the human race arose, demons and giants who devoured men, until after a while the race became nearly or quite extinct. Then came the great hero-god *Nagaynezgani*, to whom I will refer later, and killed the demons. After this, by special acts of creation, new men and women were made. Possibly the first of these creations is to be regarded as the first appearance of the true mortal Indian on the earth.

The Navajo has no faith in monogenesis, he believes in several special creations even for his own tribe. The process by which their rude gods made men in the old days was quite an elaborate one, and the Navajo shaman, in relating the myth, does full justice to all the difficulties. A full recital of all the symbolic mummeries that the divine beings thought it necessary to perform in this creative act, would be at best but tedious reading. A

brief sketch of their toils must suffice here. They took two ears of corn, one yellow and one white, the former was to become the female of the new couple and the latter the male, and it is in memory of this event, they say, that white corn is called male corn and yellow corn is called female corn to this day among the Navajos. The gods laid these ears on a large dish of pure turquoise, and covered them with embroidered blankets of different colors, and with sacred buckskins, *i. e.*, the skins of deer not slain by weapons but pursued to exhaustion and then smothered. They were laid with their points towards the east; but before they were laid down they were handed round from one god to another and each god turned them in a different direction, and this is the reason the Navajos to-day never dwell in one locality long, but wander from place to place.

From time to time the benevolent god *Has-chay'-el-thee* peeped under the covering to see how the incubation progressed, and when the ears of corn had assumed the shape of man, the wind-god entered under the blankets to give them life. He went in at the mouth and came out at the tips of the fingers. "Do you not believe this?" said an old shaman to me. "Look then at the tips of your fingers and there you will see *Niyol Bithin*, the trail of the wind." A double helical line is with the Navajos and other tribes a symbol of the whirlwind, and this symbol is impressed on the palmar aspect of the terminal joint of every human finger—satisfactory evidence to the Navajo philosopher that the wind-god, when he gave the breath of life to man, made his exit through the finger-tips. It was the gods of the white rock crystal, who live in Jemez mountain, that furnished these new beings with mind, and the goddess of the grasshoppers gave them voices. Then they rose, but at this moment a dark cloud descended from the heavens and covered them as a garment.

This pair became the ancestors of the *Tsedjinkini*, or people of the dark cliff house, the oldest gens of the present Navajo nation. The story tellers say that they are thus called because the ears of corn of which they were made were taken by the gods from certain dark cliffs. But the archæologists will be more inclined perhaps to think that the myth refers to some remnants of the ancient inhabitants of the cliff houses of Arizona, enslaved or otherwise adopted by the conquering Navajos. The myths contain several other accounts of the making of men, sometimes

the human forms are molded of moistened corn meal, while different ceremonies are performed and by different gods. But always Indian corn, in some form, is the substance used. As this has been from time immemorial the staple food of the Indian, it is not without reason that his gods have chosen it as the proper substance for making men. All Indian flesh is largely derived from maize.

It is a difficult task to determine which one of their gods is the most potent. Religion with them, as with many other peoples, reflects their own social conditions. Their government is a strict democracy. Chiefs are at best but elders, men of temporary and ill-defined influence, whom the youngest men in the tribe may contradict and defy. There is no highest chief of the tribe. Hence their gods, as their men, stand much on a level of equality. But, as you hear the myths recited, you gain the idea that at the present day the sun-god is the most potent, though very far from being omnipotent. In the earlier days of the world, and in the lower worlds, First-man and First-woman, the Coyote and the wind-gods, and, above all, the sea-monster, appear as personages of greater importance.

When the race came up from the fourth world to this, to escape the last flood, two very popular and much beloved persons were chosen to carry the sun and the moon, and all were deeply grieved when they departed for their distant homes beside the great eastern ocean. The sun-god dwells there now in a beautiful house built of turquoise. The sun is a bright shield which the god carries on his arm. The creation myth in one place describes with much exactness how he comes home after his day's work, how he hangs his shining shield on the wall, how it lights up the inside of the vast edifice, how it dangles and sways on the wall, going "tla, tla, tla" until at last the vibration stops and the noise ceases.

But, although they attribute great power to *Chohanoai*, the sun-god, it is not to him that they pray the most. It is not he who takes the greatest interest in human affairs and lends his ear most readily to human supplication. Is it because they naturally suppose the most active sympathy to dwell in the breast of a woman that they have found in a goddess their most beneficent deity? It may be so, but perhaps there are other reasons equally strong, which will presently appear, why *Estsánatlehi*, the goddess of the

west, is their most honored divinity. Various accounts are given of her origin. Some versions of the myth declare that she was found by First-man and First-woman; others add that they found her at the foot of a rainbow; but the version which I regard as the most ancient and purest gives an elaborate account of a special creation, by the gods, of two divine women, one of whom was made of a piece of blue turquoise and the other of a piece of white shell, precious substances highly valued among the Navajos. The former, she of the turquoise, was *Estsanatlehi*, the latter, called her sister, was *Yolkai-estsan*, or White-Shell Woman, who figures as a less important character in the myths. This *Estsanatlehi* afterwards became the wife of the sun-god, who like a true savage god is a polygamist. He has a wife in the east and another in the west; but *Estsanatlehi*, the goddess of the west, is beloved. She embodies attributes of various queens of heaven, of various wives of the highest deities which appear in a hundred mythologies. She has, however, none of the low jealousy and petty spite of her sister Juno; she reminds one more of the Scandinavian Frigga. If one's opinions of the Indian is based on the popular accounts of their excessive cruelty, he will marvel that such an embodiment of benevolence can have a place in their mythology. If his estimate of the social status of the Indian woman is the one most common in current literature—for she is usually represented as the over-worked slave of a pitiless master—he will marvel that to a female should be assigned such a high place among the gods. But an intimate observance of this people demonstrates that she may fairly represent the Navajo matron at her best.

The name *Estsanatlehi* signifies the woman who changes or rejuvenates, and it is said of her that she never remains in one state, but that she grows to be an old woman, and in the course of time, at will, she becomes a young girl again, and so passes on through an endless cycle of lives, changing but never dying. In the light of this narration we see her as none other than our own Mother Nature, the goddess of the changing year, with its youth of spring, its middle age of summer, its senility of autumn, growing old only to become young again. The deity of fruitful nature is, it will be admitted, fitly a goddess, and fitly also the wife of the sun, to whose potent influence she owes her fertility. Our Aryan forefathers never conceived a more consistent myth

than this. But why is she the goddess of the west? Let it be remembered that the Navajo land lies to the west of the continental divide, and slopes toward the setting sun. The Pacific, not the Atlantic, is the reservoir from which it draws its scanty moisture. From the west, not from the east, come the storm-clouds of the summer and the soft thawing breezes of the spring. Hence naturally this beneficent goddess, who loves her Navajo children so well, dwells in the western ocean, and from there dispenses her bounty. While she still lived in the Navajo land, and long before she journeyed to the west, she was blessed with a child whose father was the sun, at the same time her sister bore a child whose father was a water-fall, or, as some versions make it, a rain-storm. These boys were *Nagaynezgani* and *Thóbadjischeni.* One version of the myth says they were both children of *Estsanatlehi* and the sun. They are called brothers throughout the myth; but according to the Indian system of relationship their mothers being sisters constitutes them brethren as well if they were children of one mother.

These are the sacred brothers, the Dioscuri, who figure in the myths and legends of so many races not only of this continent but of the old world as well. Comparative mythologists usually regard the sacred brothers as myths of night and day, of light and darkness. Max Müller regards this as the proper interpretation of the Asvinau of India, but Mr. Talboys Wheeler, in his History of India, says they are "apparently a personification of light and moisture," and this I believe to be the true explanation of the Navajo myth, for the name *Thobajischeni* signifies Kinsman of the Waters, and the portion of the myth which refers to his paternity strengthens this theory.

Both of the brothers receive homage as gods of battle, but *Nagaynezgani* is regarded as the more potent of the two. It is to these that men offer their sacrifices and prayers when they are about to go on the war-path. The sacrifices may be offered anywhere, but their special shrine is at *Tho-yet'-li,* a place at the junction of two rivers in the valley of the San Juan, somewhere in what is now the Territory of Utah. Hither it is said they went to dwell when their mission on this earth was done, when they had slain all the more powerful demons and left man with no worse enemy in the world than his own kind. Here it is said they still dwell, and here their reflection is still to be seen on the

waters of the San Juan river. This part of the myth doubtless refers to some natural phenomenon observable at this point, but I know not what it is, for I have never visited *Thoyetli*. If the Navajo would have special fortune in some war, he must make a pilgrimage to the far *Thoyetli* and lay there the sacred cigarettes for the gods to smoke.

Nagaynezgani is distinctly an Indian war-god, and the god of an especially shrewd and crafty tribe even among Indians. Like Thor he is the terror of evil spirits, but unlike Thor the evil spirits never outwit him. He too has the thunder-bolts for weapons, but he has not an unlimited supply of them. He must husband them, even as the Indian husbands his well-made arrows. His chief weapon is a great stone knife; but he depends not so much on his weapons as on his presence of mind, his craftiness, his powers of dissimulation and, above all, on his "medicine." He is no coward, no vacillator, once sped on his journey he never returns unsuccessful; but in accomplishing his purpose he exhibits more the character of the cunning Ulysses than of the bold Hercules.

It is not, however, the warriors alone who pray to him, he is appealed to by all classes of suppliants as well, and there are songs in his honor in all the rituals that I have yet learned. Here is one of the songs taken from the great rite of the *Zilyidji Hathal* or Mountain Chant. It is a literal translation. I have only chosen such English forms and phrases as would represent, to some extent, the excellent rhythm of the original Navajo song, which is a monologue on the part of the god:

I am the slayer of the alien gods,
I walk afar;
From out the hole that passes through the sky,
I walk afar;
My enemies assail me, but in vain,
I walk afar;
My foes of all sorts stand in fear of me,
I walk afar;
I go on errands of a dangerous kind,
I walk afar;
Upon the highest of the mountain peaks,
I walk afar.

In the Navajo language all not of their own or cognate tribe are called *ana*, or *na*, *i. e.*, foreigners or aliens. The minor gods or genii are called *yay* or *gay*. Hence *anagay*, or alien gods, is

a term applied to all those supernatural beings who once devoured and harassed mankind. *Nezga* means to kill by violence, to slay, and thus we have *Nagaynezgani*, Slayer of the Alien Gods, a name which has its very close analogue in that of Jack the Giant Killer. His mission in life was to destroy these alien gods, which he did with a few exceptions, notable among which were the gods of cold, hunger and old age. These creatures pleaded so well for their lives, and demonstrated so well to the hero that they were not unmixed evils, that they were spared to still torment man. As a specimen of the Navajo way of reasoning, I will relate his adventure with *Sakaz'-estsan'*, the Cold-woman:

When he returned from his adventure with Old-age, he said to his mother, "Tell me where the Cold-woman dwells," she did not answer him; four times he repeated the question, when she replied, "You have done enough, my son. Seek to slay no more." But the wind-god whispered in his ear, "She dwells on the summit of *Depentsa*" (the San Juan mountains). So he set forth and traveled to the north and wandered around over the highest peaks of the mountains until he, at length, encountered a wrinkled old woman sitting nearly naked on a bed of snow. She had neither food, fire nor shelter, her eyes streamed tears, she shivered constantly and her teeth chattered so that she could scarcely talk. He knew at once that she was *Sakaz-estsan*. A vast crowd of snow-buntings flitted around her. These were the couriers whom she was accustomed to send forth to announce the coming of storms. They were the spies who told her what was going on in the outer world. As he approached her he said, "I have come on a cruel errand. I have come to kill you that man may suffer no more torture from you, or die at your hands." "You may kill me if you will," she chattered, "but man will be worse off when I am dead than he is now; for when I die it will be always hot, and the land will dry up, and the springs will cease to flow, and men will die of heat and thirst. You will do better if you let me live." So he lowered the arm he had raised to kill her, and reflected a moment. "Grandmother, you speak the truth," he said at last; "you shall live," and he returned to his mother's dwelling without a trophy.

His journeys in which he failed to listen to the voice of mercy are, however, much more numerous than those in which he re-

lented, and, had I space to relate them, the reader would hear of many myths with which he is already familiar in tales of our own antiquity and in the folk-lore of modern Europeans. Many characters with whom he has become acquainted in the pages of Grimm he would meet again, but dressed in buckskin and disguised in paint and feathers.

The ancestral prairie wolf, the apotheosized coyote, is an important figure in their mythology, as he is in the mythologies of all our aborigines to whom the coyote was known, and in their earlier fabulous ages, particularly when the Navajos dwelt in the lower worlds, he was a potent god. Closely allied to the fox in nature, he has so many mythic similarities to the reynard of European folk-lore, that we can not but suspect that our own distant ancestors once worshiped the fox-god. In Arizona, as in Europe, he always appears as a cunning, deceitful mischief-maker.

It was the Coyote who brought about the expulsion of the people from the lower world. He stole the young of *Tĕholtsodi*, the sea-monster, and the latter in revenge, or in order to rescue the lost ones, caused the great floods which drove all up to the surface of this earth. It is Coyote who is responsible for the present irregular position of the stars. He usually had the laugh on his side as the result of his trickeries, but he was not always so fortunate.

Once he went out hunting with his father-in-law, and they rested at night on the top of a rugged mountain where they lit their camp-fire and cooked some meat for supper. As they were lying down to sleep Coyote said to his companion, "This hill is called the Hill of the Burned Moccasins." As the old man had never heard of this extraordinary name before, he could not help wondering at it until the wind-god whispered in his ear, "Change your moccasins;" so before he fell asleep he took the Coyote's moccasins and put them under his own head, while he put his moccasins in place of the Coyote's. Late in the night the Coyote rose softly, took the moccasins from under the old man's head and buried them in the hot embers. When they woke in the morning the old man pretended to look in vain for his lost moccasins, "Ah!" said Coyote, "You have forgotten that this is the Hill of the Burned Moccasins." "Oh! there they are under your head," said the elder; "I thank you, my son-in-law, for

taking such good care of them." "Yes," said Coyote, "I have taken care of them for you; but the ground is so nice and soft on this mountain I think I shall prefer to go barefoot to-day."

Not only is the prairie-wolf a god, but nearly every animal in the Navajo land has its own apotheosized prototype, its generic ancestral god. All of these gods have their special place in the mythology of this people. Many of them have to this day special sacrifices proper to them which are prepared in the medicine-lodge and offered according to established ritual. The Navajos then are zoölaters; that is, in common with all the still pagan aboriginal races of our continent, they worship the lower animals; or perhaps it would be more proper to say they worship zoömorphic gods. A degraded form of worship no doubt many of my readers deem it; but it should be remembered that zoölatry was common to all the races of antiquity, and that a marked remnant of it is our own heritage to this day.

Besides all these gods, the Navajos have a host of local divinities so numerous that I never hope to get a complete list of them. The Navajo land is, or was, bounded by four great mountains, Jemez on the east, San Mateo on the south, San Francisco on the west and San Juan on the north. The resident deities of these great peaks seem to receive more honor than any other place-gods, but the presiding genii of other mountains, rocks and cañons are not neglected by the devout. No people are more ingenious than our American aborigines in framing fanciful stories of locality. The Navajos particularly delight in this form of myth. Their land abounds in strange geologic formations, in rocks fancifully sculptured by the elements, and it abounds equally in myths accounting for these features.

Some recent writers have stated that our American Indians as a rule offer prayer and sacrifice only to evil spirits, believing that time is wasted in endeavoring to gain the favor of beings who are always benevolent. Among the Navajos, at least, I can venture to assert that such is not the case. The gods seem to receive worship in proportion to their reputation for good-will towards men. Indeed, according to the Navajo's mythology, the evil gods have nearly all been destroyed, and his worst conceptions of malevolence are altogether things of the past.

CAUSES OF FOREST ROTATION.

BY JNO. T. CAMPBELL.

(Continued from p. 527, June number.)

SINCE my article on the above subject appeared in the June NATURALIST, I have received a good number of letters, both from acquaintances and strangers, some making further inquiry about some phases of the subject, some offering explanations different from mine to account for forest rotation, and still others ridiculing my theory that seeds, especially nuts, are carried by crows, wood-peckers and squirrels sufficient to plant such large districts of young forest trees as suddenly spring up where forests of a different timber have been cut away, or such as have sprung up on the prairies of the Wabash river second bottoms since the white settlers have stopped the burning of the prairie grass.

I have been struck with the number of persons who seem to believe (as indicated by this correspondence) that when a forest is swept away by the axe, fire or a blight, a different kind of forest springs up spontaneously out of the soil. I admit that it has much that appearance. Especially does it appear to be so with weeds and grass, but the seeds of the latter are so small that it is about impossible to keep track of them; but forest trees that grow from nuts we may more easily observe, and if we find that their seeds have been carried far beyond their fall from the parent trees, and planted so as to produce trees, we may, I think, take the planting of weed and grass seeds for granted.

Dr. Clevenger, of Chicago, in a letter says, in speaking of the oak following pine in Minnesota, where the latter was cut off of the railroad sections: "My idea was, that during hundreds of years the chemical constituents of the soil having been drawn upon for the sustenance of pine, something near exhaustion had occurred, or at least enfeeblement of the ground, and that a seed which in its development required different soil constituents, or complementary ones, would be most apt to succeed the pine. The oak seems to be universally the terebinthinate follower in Scandinavia, Scotland, England, America and elsewhere. * * * For hundreds of miles along the Minnesota division of the North Pacific railroad, the alternate sections of cleared and uncleared forest presented, the year after clearing, a checker-board aspect of young oak and old pine. Then why should beeches and larches

everywhere follow the oak destruction? It seems to me the true explanation comes in climatological changes as minor, and soil-chemistry changes as major causes."

I admit the puzzle the doctor produces. Perhaps neither of us is right in accounting for forest rotation. My theory—which I have offered only as a suggestion or query—that perhaps most forest seeds will not grow in the leaf-fall of the parent tree, and that nuts are transported long distances and in great numbers by crows, woodpeckers, squirrels, &c., while it is possible, and seems to me probable, may not be the *fact* that accounts for oak following pine in Minnesota in the manner stated. But I must be allowed to believe a few days longer that an oak starts from an acorn.

It is remarkable how often we all (and many very intelligent and scientific persons are included) ponder, wonder and speculate about a phenomenon, the evidence to solve which lies at our feet. If the doctor, while on the ground, had examined a few of the infant oaks, I think he would have found an acorn attached. And if he had, the only unsolved question remaining would be—How did the acorn get there? As it is, the first question to settle is whether the oak came from an acorn or spontaneously from the ground. In my locality the acorn and the dark mold-cast which it leaves in the ground can be identified as late as the third year after sprouting.

Professor George K. Greene, of New Albany, Indiana, writes: "If you were to visit the section of country in Harrison county, Indiana, called the "barrens," you would find an area of several thousands of acres all grown up with post oaks (*Quercus obtusiloba*). There are citizens residing in the vicinity who came there when there was no timber on the ground. Can your crows and squirrels account for this?"

I will answer this by describing the work of the crows in this vicinity about the year 1847. John Williams loaded a flat-boat with chickens for the New Orleans market. Such a boat could, and his probably did, carry three thousand chickens. Of these two thousand would be hens, as the farmers generally kill the males for their own table use. This boat in running over Manwarring's mill-dam sprung a leak and sunk so fast that all the chickens had to be turned loose in the woods on the north side of the creek, and about a half mile above where it enters the

Wabash river. There the hens laid about two thousand eggs a day for about a week, while the boat was being repaired, making about fourteen thousand eggs laid. The crows carried these eggs —how many I can't say—southward across the creek and buried them in Huxford's field, more than a half mile distant. That was in early spring. Soon after Huxford and his boys broke that field for corn, and the plow turned up hundreds of eggs, and perhaps thousands, as they were too numerous to think of counting. When the broken ground was afterward furrowed off for planting, many more eggs were exposed, and after the corn came up and was being plowed, hundreds more were exposed. Very probably the plows exposed less than two-thirds of those buried, as the plow-cut would go below the depth likely to be buried. Huxfords took their dinners to this field, and they cooked the eggs thus found by the fire where they made their coffee, and the eggs remained good till the first plowing of the corn in early May, when they became tired of them and ceased to notice them further. John Huxford, a wealthy farmer of this county, and one of the boys who plowed the field, told me about finding and using the eggs.[1] The "stoving" of Williams' chicken boat I myself remember, as I then lived with an uncle on Sugar creek, not more than three miles distant from the field.

Might this not be a good way to preserve eggs? The field was dry, alluvial, rather sandy soil.

Suppose the eggs had been acorns, and the field had not been disturbed with the plow, and also suppose the rank bottom-weeds

[1] Since writing the above, I have seen and talked again with Mr. Huxford, and find that I am mistaken about an immaterial fact. It was not the boat that was injured on the mill-dam, but one that was built there several years later. The farmers brought their chickens in before the boat was ready, and turned them loose in Cheezem's orchard on the south side of Sugar creek. The crows carried the eggs across to the north side of the creek, and buried them in the Chatsey field (which was sold for taxes, and Huxford bought it). The balance of the statement is correct. I presume I inferred the stove boat, because it occurred at the same place.

I have told this circumstances often, and have found people who manifested some skepticism, because of its rare occurrence. But I have also found several other persons who have found eggs buried in the ground, and they also say the eggs appeared to be sound when found. Hens, when not too much confined, hide their nests, and the cautious crow does not venture into ambush to find them. It was *then* rare that chickens were crowded together but uncooped, in such numbers, and since shipments are made by railroad it never occurs; so of course the case is a rare one. Any one acquainted with the habits, or nature of the crow, knows he is much given to carrying things from place to place and burying them.

had exercised polite forbearance and kept out of the way; would there not have been founded a dense oak forest?

In the fall of 1876 and winter and spring of 1877, I was surveying a line of railroad in Southern Illinois. About five miles west of Benton, the county seat of Franklin county, the line of survey cut across peninsulas of prairie extending into the timber, and likewise peninsulas of timber extending into the prairie. These are called arms of prairie and points of timber. The old timber followed up the small streams into the prairie. The buffalo and deer, in past time, kept the grass eaten and tramped down along the water-courses where they drank, thus greatly reducing if not entirely preventing the destructive prairie fires from consuming the young trees; hence the points of timber following up the streams. In the locality I am describing the timber was almost exclusively white oak. After the settlers stopped the prairie fires, these points of timber began to widen and crowd on the prairie, and in the last forty to fifty years the young oaks had extended out about a half mile from the old timber, and they ranged in height from about fifty feet next to the old trees, to the infants just emerging from the ground out at the frontier. At that frontier I saw oaks, not over four feet high, bearing acorns—keeping the seed right up to the front. In Indiana, where it is unnecessary for trees to perform the parent functions so young, I never saw a white oak less than thirty feet high bear acorns, and not then among older oaks.

In the second or terrace-bottoms of the Wabash river, when the whites first settled them, they found most of them to be prairie, grown up in weeds, the prairie grass had not yet got possession of the ground except in patches. They found also scattering and stunted white oaks, black oaks (*Quercus nigra*) and jack oaks (*Quercus ferruginea*). The Indians had, for an unknown time, burned the prairie weeds and grass, which not only killed the infant trees but greatly injured the old ones, especially on the south side, where to-day, notwithstanding seventy years of protection from fires, they still show the scars, though generally healed over, and on their sawed-off stumps can be read the true history of their lives. After the prairie fires were effectually stopped, a dense growth of young trees sprang up, and to-day they are fifty to seventy-feet high, vigorous and thrifty. Last year I had occasion to hunt for piling timber in a grove of this

timber on the Walker farm, about twelve miles north of Terre Haute. Some one had sawed down many of the trees, for some purpose, and while waiting for a team I counted the age of the trees by the concentric annual rings on the stumps. Notwithstanding that their diameters varied from six to twenty-two inches, every one of forty I counted was sixty-four years old. Their ages tallied with the date when the fires were suppressed. The prevailing young trees in that grove were jack oak, though there were a few white oaks, hickories, poplars and black walnuts among them, and these were as tall and thrifty as the prevailing kind. The prevailing old scattered, stunted trees of that locality were white oak, but the young white oaks showed no lack of thrift and vigor in growing by the stumps of their parents.

In Ohio, on the east side of the Big Miami river and about a half mile south of the line betweeen Hamilton and Butler counties, Old Major Cilley (a relative of the Cilley who fought a duel with Graves, in Jackson's time) undertook to clear ten acres of land on the Miami hills. This was about seventy to ninety years ago, I am not sure as to exact date. He felled the trees when in full leaf, and after they were well dried, fired them and burned everything clear. The next spring the black locusts sprouted as thick as weeds in a field, wherever the fire had been. For some reason the ground was not plowed, and the trees soon grew to be valuable timber, as it makes the best of fence and gate-posts. There were a few parent black locust trees in the vicinity, but they were by no means the prevailing forest tree there. Their seeds resemble an apple seed, are very hard, and must undergo a process of scalding, scorching or very hard freezing and then have a clear field before they will grow. Their seeds being small are easily carried by the wind, and are so impervious to ordinary weather influences that they may lie among the forest leaves many years, and when some subsequent favorable condition transpires, as the burning of Cilley's fallen timber, they sprout into life and make a locust forest.

In further consideration of Dr. Clevenger's idea of soil exhaustion as the cause of a change in the kind of timber, I will say that in all the pine forests I ever saw, the individual pine trees showed no more evidence of enfeeblement, as I should expect in case of soil exhaustion, than do the trees of the forests here, where all kinds grow promiscuously together. A few years would

test this question, if somebody would plant an infant pine and oak together near a grown oak, and the same near a grown pine. There should be several of each plant to guard against accidents to either kind spoiling the comparison, and then observe their comparative progress a few years. Has anybody ever done this? Will somebody who has an opportunity please do so?

——:o:——

BUFFALO AND CHICAGO, OR "WHAT MIGHT HAVE BEEN."[1]

BY PROFESSOR E. W. CLAYPOLE.

THE great spectacle which Buffalo can show to the members of the association needs no description. Met as we are, almost within sound of the cataract, we are tempted to ask concerning it many questions, to answer which would not be easy. But to us who compose the Section of Geology, Niagara is a study of peculiar interest. The structure and age of its rocks, the formation of the great gorge and the various causes that have combined to produce it, all these topics have received careful consideration, and though our queries are far from being fully answered, yet the partial replies already extorted from nature are deeply interesting and strongly suggestive.

Most of these points are, however, familiar to geologists, and I do not therefore propose to dwell upon them. They have already claimed and will again claim our attention. But there is one, both curious and interesting, to which I wish to refer for a few minutes.

In the study of history it is often both entertaining and instructive to stop in one's regular course, and dropping the thread of the narrative of actual facts, to consider what might have been the course of events had certain great and critical occurrences not happened at all, or happened in a different manner or under different conditions. These "might have beens" of history, though of course impossible, are not necessarily useless to the student. A consideration of some of them sometimes shows us on how slender a thread have depended most momentous results. The delay of a few hours, the failure of an apparently unimportant coincidence would in many cases, so far as we can see, have

[1] A paper read in abstract before the Geological section of the A. A. A. S. at Buffalo, August, 1886.

changed the whole current of subsequent events to whatever extent those events were dependent upon them. And in like manner in geology, by stopping to think, not on what has happened but on what might have happened, we sometimes discover a whole train of consequences flowing from some apparently insignificant cause which might seemingly just as well have happened differently or have not happened at all. To one of these geological "might have beens" I venture to ask the attention of the section to-day, in the hope that it will not be quite without interest, seeing that, as I have already said, we are met on this classic ground in a city whose destiny—whose very existence I may say—was determined by the possibility to which I wish to allude.

The Great lakes of North America are one of the most singular hydrographical features on the surface of our earth. A great part, perhaps nearly a half of all the fresh water on the planet, is dammed up on the top of a table land between five and six hundred feet above the sea. At least this is true of the four upper members of the chain, Erie, Huron, Michigan and Superior. The long irregular rim surrounding this great inland sea varies in height from 1500 feet above tide down to the lake level. Of course in so long a water-shed there are many low places. But with most of these we have no concern.

There are, however, two of these low places that involve interesting geological possibilities. These are Buffalo and Chicago. Buffalo is the outlet port and Chicago is the port at the head of lake navigation. The relationship of these two cities to one another is not accidental or determined by man, it is based on geological causes over which man has had little or no control. Yet a geological study of the region shows us that solid as is the base on which stand the destinies of these two cities, there yet have been critical epochs in the development of the lake district when a very slight difference would have been sufficient to change, even to reverse their relations to one another.

II.

The channel of the Niagara river at Black rock of course marks the present lowest point in the water-shed or rim of the lake basin. It also proves that this was the lowest point when the flow of the Niagara river began. Any one who has been down to the outlet has observed that the land on both sides is

flat and raised only a feet feet above the water. Now Lake Michigan is only ten feet above Lake Erie, and the land behind Chicago is not more than twelve feet above Lake Michigan on the water-shed between it and the Mississippi basin. This low place on the river is therefore less than twenty-five feet above the water level at Black rock. It follows then that a dam of that height across the river at Buffalo would stop its flow and throw the stream over the low ridge at Chicago into the Des Plaines and the Mississippi. In like manner a cut sufficiently large through this ridge would drain off the water and leave Niagara dry. Chicago would then be the outlet and Buffalo would lie at the head of lake-navigation. Such is the delicacy of the natural adjustment that has determined the relation of the two cities. We may liken the lakes to a fountain-basin having two notches in its rim of about the same depth. The slightest tilt may suffice to throw all the waste water over either of these notches and leave the other dry.

But a dam of the size imagined would be a task of vast magnitude. This is true if regarded as a work of human engineering. But we all know that at no distant date, geologically speaking, the whole region in question and much more of the northern part of the country was covered with a sheet of ice, and that this ice moved immense quantities of earth, sand and stone from place to place, depositing them far from their previous resting spots. Sometimes this great transporting agent dropped its load of wreckage in long lines across the country, as may be seen in the great terminal moraine recently traced from Long island nearly to the Rocky mountains by the labor of Wright, Lewis, Chamberlin, Upham and others. In other places these moraines are less extensive and bulky, though equally evident. They vary in height from ten or twenty feet to three or four hundred feet, or even more, and in breadth from a few yards to several miles.

Now let us in imagination suppose that the retreating ice had dropped one of these moraine lines across the course of the present Niagara river, near the place of its outflow from Lake Erie, as it dropped them in many other places. The possibility might then be realized. Had one of the ridges so common in Northern Ohio been formed at Black rock, the Niagara river might not have begun to flow, and the ultimate outflow of the lakes might have been by Chicago.

III.

But this is not the whole story. Things were not always as they now are. If the equilibrium in the drainage of these lakes is now so delicate, there was a time when it was more delicate still, and when no man could have determined in which direction the outflow would ultimately go. There was a time when the whole northern part of the continent was covered with ice. As the climate grew warmer this great ice-sheet drew back. Its edge retreated northward slowly exposing the underlying ground. In this way Lake Erie and adjoining country were step by step freed from their icy covering. When the ice had melted sufficiently the Niagara river began to flow. Into all the details of its early course I cannot enter. Many of them are still uncertain. But there came a time when the level of Lake Ontario was lowered sufficiently to allow the water to pass into it from Lake Erie. Then the Niagara river was born and the direction of the lake drainage established. Then began the flow of the most beautiful river of the continent, the St. Lawrence, with its clear green water, seldom sullied, and its almost unvarying level both in summer and winter.

Now there is ample evidence that in former days the level of the Niagara river was much higher than it now is. Professor Hall has pointed out in his "Geology of New York," and Sir C. Lyell in his "Principles of Geology," the existence on Goat island and at various points along the river of alluvial strata containing recent shells. Terraces consisting of this material skirt the stream for a long distance, and rise in some places forty or fifty feet above the water. The fineness and softness of these deposits shew that they were laid down in still or slowly flowing water. The highest beds are nearly on a level with the surface of the lake, and they were of course at the bottom of the water at the time of their deposition. Hence it may be inferred that the lake and river both stood then higher than now. It would appear that at the time when these beds were deposited with their contained shells, an arm of the lake or else a very sluggish stream must have extended northwards along the present channel of the Niagara, of course before the excavation of the gorge or the full development of the cataract. Considering this fact we are compelled to ask where was the dam that held back the waters so that they were able to deposit sediment so far

above their present level. To this question only one answer seems possible. The dam was the ridge of Queenston heights, now forty feet above the lake-level. Here is a barrier sufficient to confine the water till it reached the required height.

But the objection naturally rises: If the crest of the Silurian escarpment at Lewiston is forty feet above Lake Erie, how could the river take its course in that direction and not over the Chicago ridge fifteen feet lower?

Three answers are possible.

1st. The point at which the river crossed the ridge must have been rather lower than the adjacent portions. A stream always chooses the lowest ground. Now it is just possible that this point was so much below the rest of the ridge that it was lower than the notch at Chicago, and therefore determined the outflow in the northeasterly direction. This, however hardly amounts to a probability, and certainly deserves no more than mention.

2d. Most geologists are agreed that during the ice age the northern or north-eastern part of the continent was depressed much below its present level—in some places many hundred feet below it—and that as the ice age passed away it slowly recovered nearly its former elevation. The presence of recent arctic shells on the tops of hills, as at Mount Royal, Montreal, is decisive proof of this. I will not now discuss the cause, it does not concern the subject. But in view of the fact that the ridge at Queenston is far to the east and somewhat to the north of Chicago there is nothing improbable in the supposition that it was lower in depression and later in reëlevation. Hence at the time in question it may have been so far below its present height as to have been actually the lower of the two, and have thus determined the outflow of the water by the ordinary laws of drainage. If then the river was capable of cutting it down by erosion as fast as it rose by continental elevation, the channel once established would be permanently maintained. And there is no reason to doubt the competency of the Niagara to accomplish this task.

3d. But there is a third and a more likely answer yet. The slow northward retreat of the ice exposed the southern and southeastern portions of the country first, holding the north and northwest covered till a later time. Hence the conclusion is unavoidable that after the Niagara district and Central New York were

free and the northern or eastern outlet opened, the channel at Mackinaw was still ice-locked and no communication was therefore possible from Lake Erie to Lake Michigan. The water was thus ponded back and could not flow over the low dam at Chicago because of the existence of a high ice-dam at Mackinaw. It was therefore compelled to rise until it was high enough to overflow at the next low point—the ridge of Queenston—at whatever height that ridge may then have stood.

IV.

The relationship then of Buffalo and Chicago as the outlet and the head of lake navigation depends on a series of geological changes whose results are so nearly in equilibrium that at certain epochs a trifle would have been sufficient to reverse them. As with some of the lakes and streams in Northern Ohio, the breaking of a dam or the cutting of a ditch is enough to divert into the Mississippi water that previously flowed into the St. Lawrence.

Summing up the result above obtained, we find that the Niagara river would probably never have existed and that the drainage of the four upper lakes would have flowed past Chicago into the Mississippi,

(1) If the ground at Black rock had been about twenty-five feet higher when the river began to flow.

(2) If the ridge behind Chicago had been lower by the same amount.

(3) If the Silurian escarpment at Queenston had been as high as it is at present.

(4) If the reëlevation of the land after the ice age had been more rapid.

(5) If the ice-dam at Mackinaw had melted before that to the north and east of the lakes.

In any of these cases it is probable and in some of them it is certain that the water now flowing by Black rock would have gone through Illinois. Buffalo would have been Chicago and Chicago would have been Buffalo.

A long series of consequent changes of other kinds would have resulted from the reversal of the relationship between these two cities. The course of the discovery and development of the country could hardly have taken place along the same lines, and the great highways of traffic and communication, especially in

early days, would have taken different directions. But the following out of these subjects is not within the province of a geological paper.

NOTE.—Since the above paper was written I have been favored by the courtesy of Mr. O. Guthrie, of Chicago, with a copy of the Report of the Committee on the Drainage of Chicago, and a letter containing some further interesting details upon the subject. From these data I learn that the low ridge behind Chicago, mentioned in the above paper, has a breadth of only five miles, and that a scheme is on foot for cutting a canal or a channel through it to the Des Plaines river in order to carry away the sewage of the city entirely from L. Michigan, and avoid the contamination of the water-supply, whose purity is now seriously endangered by the flow of drainage into the lake not far from the crib, during floods in the Des Plaines river.

——:o:——

THE ARTHROPOD EYE.

BY J. S. KINGSLEY, SC.D.

THE year 1886 has already seen several important studies upon the eyes of Arthropods, some of which have materially altered our conception of the organ and of compound vision. Of these studies by far the most important are those detailed in Dr. William Patten's "Eyes of Mollusks and Arthropods" (Mitth. zool. Stat. Neapel, VI, pp. 542–756. pls. XXVIII–XXXII, 1886). The paper is far too long for complete abstract here, but some of the more important points relative to the compound eye may be useful in supplementing the statements in the manuals of comparative anatomy. Incidentally it may be remarked that the matter pertaining to the eyes of mollusks is equally valuable.

As described in our hand-books, our knowledge of the eyes of Crustacea, spiders and insects is based on Grenacher's classic "Sehorgan der Arthropoden" (1879), and no one (Graber excepted) has ventured to criticise his results. Not so Dr. Patten. He has shown that Grenacher is wrong in many fundamental points, and that his conception of these organs is in some respects so erroneous as to be all but worthless. The writer, in passing, may remark that he has had occasion, in studies in a somewhat different direction, to verify many of Patten's statements, and so far as he has gone he can confirm them. The figure of one of the elements of the eye of the shrimp, illustrating this article, is drawn from his own preparations, but in all essential features it agrees well with similar figures of the eyes of other Crustacea given by Patten. The

ramifications of the distal end of the optic nerve were not seen and have been inserted from Patten.

On the external surface of the compound eye is the facetted chitinous cornea, each facet of which is regarded as a lens (*l*). Immediately beneath this comes a layer of epidermal (hypodermal) cells, *e*, the existence of which was utterly ignored by Grenacher. These secrete the cornea. Next in order are some cells (retinophoræ, *r*) which are rather complex in their structure and relations. There are four of these to each facet, and they lie exactly below the corresponding epidermal cells. The nuclei are placed in the outer ends, and thence the protoplasm runs backwards to the basal limit of the retinal portion of the eye marked by the line at *b* in the figure. A short distance from the surface they contract to form a slender stalk or style (*s*), and these enlarge, in a graceful manner, to form a pedicel (*p*).

Between the nucleated portion of the retinophoræ and the style are some features existing in the shrimp and some other forms, but not in all. This part of the cells in the form figured is extremely thin, and the space between the four cells which make up one optic element, or 'ommatidium,' is occupied by a transparent body, the crystalline cone (*c*). Below the cone the retin-

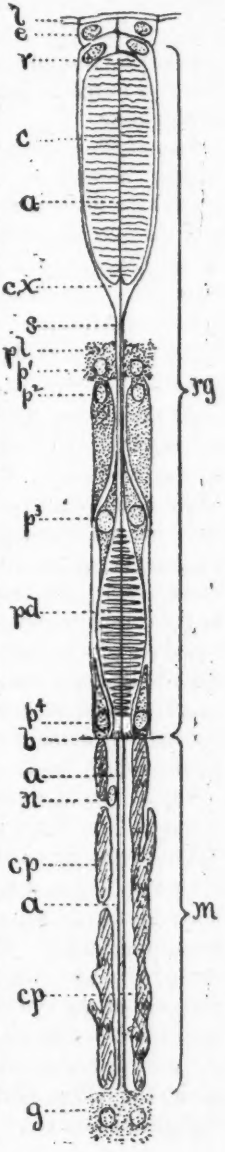


FIG. 1.—Diagram of a single element (ommatidium) of the eye of a shrimp (Crangon). *a*, axial nerve fiber and its distal terminations; *b*, base of pedicel; *c*, crystalline cone; *cp*, connective-tissue pigment; *cx*, calyx formed from retinophoræ; *e*, epidermis (hypodermis); *g*, ganglionic layer; *l*, corneal lens; *m*, mesoblastic portion of eye; *n*, nucleus of connective tissue; *p*, *p*1, *p*2, *p*3, *p*4, pigment cells and nuclei; *pd*, pedicel; *pl*, external pigment layer; *r*, retinophora; *rg*, portion of eye derived from retinogen. The termination of the axial nerve in the crystalline cone is supplied from Patten, the rest is drawn from actual sections.

ophoræ are slightly enlarged. It is, however, with regard to the pedicel that one of Dr. Patten's most important discoveries were made. According to Grenacher, this part (his rhabdom) is secreted by the surrounding pigment cells, but Dr. Patten claims that it is in reality but the coalesced proximal ends of the four retinophoræ.

Surrounding the portions of the eye already described are a varying number of pigment cells (about sixteen in Crangon); around the nucleus these are large, but at either extremity they thin out into fine threads or rods which, according to Dr. Patten, extend, like the retinophoræ, from the epidermis to the basal membrane. I have not been able to trace these extensions except in part, and hence have omitted them in the drawing. It seems probable that a variation occurs in these rods with the species, though Dr. Patten (p. 637) is inclined to the contrary view.

At the base of the ommatidium a large nerve fiber (*a*) is seen coming from the deeper portion to the base of the pedicel. According to Patten this divides just before reaching the basal membrane, and gives off branches to each of the cells (pigment cells, retinophoræ) composing the optic element. And farther, branches go to adjacent elements so that each ommatidium receives its nerve supply from four different main bundles. The arrangement of these is very complex, and need not be described. The fiber, however, which penetrates the axis of the pedicel seems of more importance to a conception of the phenomenon of vision, and hence a word is necessary. It runs through the pedicel and style and penetrates the crystalline cone, where it gives off fine fibrillæ which radiate in every direction towards the outer wall. These are points which seem to have escaped all previous observers. The writer has traced the axial fiber into the cone, but has not seen the other details.

Of the various theories and conclusions advanced by Mr. Patten as results of his studies, we have room to mention but three: First, the existence of the radiating fibers in the crystalline cone (or in the retinophoræ when the cone is absent) shows that at that part of the eye the image is formed, and the suggestion at once follows that by the depth of this layer of fibers there is adequate compensation for lack of adjustment, for no matter where the image produced by the lens may fall, it will fall upon fibers of the nerves. So too these observations tend to throw

discredit on the "mosaic" theory of the vision of the compound eye, a theory that already was too open to objection to be implicitly accepted. Lastly, a point to be referred to again, Dr. Patten comes to the conclusion that the compound eye can not be regarded as evolved by a coalescence of ocelli.

A second important paper on the Arthropod eye has already been mentioned in the pages of this magazine, but its connection with the subject in hand will excuse its being brought up again. Though several authors have mentioned facts in the development of the arthropod eye—some, like Bobretzky, giving details of importance—Mr. Locy was the first to indicate the most important feature in the process. In his paper entitled "Observations on the development of *Agelena nævia*" (Bulletin Mus. Comp. Zool., XII, pp. 63–103, 12 pls., 1886), he shows that in an early stage the eyes appear as local thickenings of the epidermis followed by an invagination of these thickened portions which thus come to lie beneath the surface. The pouches thus formed, one for each eye, are then cut off from the parent layer, and we have now to deal with three layers. From the outer (epidermal) arises the cuticle, cuticular lens and vitreous body of the adult; from the middle arises the retinal elements of the adult (exactly how was not clearly determined) while the fate of the inner layer was not traced. Locy points out that as a result of this mode of development, one supposed difference between the eyes of arthropods and those of vertebrates disappears, and the rays of light traverse the retinal elements of the one group in exactly the same direction with regard to their origin as they do in the other.

Sedgwick (Quart. Jour. Micros. Sci., XXV, 1886) was the first to point out that the eye in Peripatus was developed from an invagination. The outer wall of this sac is described as forming the epithelium outside the lens of the adult eye, while the inner wall joins the cerebrum and gives rise to the retina. Hence, says Sedgwick, the eye of Peripatus is a cerebral eye.

Kennel has also studied the development of the eye in the same genus (Entwicklungsgeschichte von Peripatus, II Theil. Arb. z. z. Inst. Würzburg, VIII, pp. 1–93, pls. 6, 1886), and gives (pp. 31–33) further details. He too recognizes the invagination, which becomes cut off from the parent layer, but says that its inner wall has no close connection with the rudimentary brain, but that the nervous connection with that organ is secondary.

This is the most important difference from Sedgwick's very brief account. Certainly Kennel's figures do not support the view that we have here to do with a 'cerebral eye;' but it must be borne in mind that he and Sedgwick are studying different species.

Next comes a preliminary communication on the development of the ocelli of Hymenoptera, by Carrière (Zoologischer Anzeiger, IX, pp. 496–500, 1886). Here the optic epidermis becomes at first two cells deep, and then these become obliquely invaginated, both layers retaining their "normal" position. The outer layer forms the lens-generating cells, the inner the retina-forming ones. The cells which are not invaginated become elongate and, together with the invaginated lens-building cells, form the corneal lens. These cells never lose their connection with the epidermis while those of the retina do. The cavity of invagination does not close up but is occupied by the corneal lens. Thus runs Carrière's account; but it is very difficult to understand it, as it is not illustrated.

I have now a few observations of my own to record. In Crangon the eyes arise from invaginated pits, and here as in the spider, Agelena, we have three layers to deal with. These are the unmodified epidermal layer and the two walls of the invaginated pouch. The one of these latter which comes to be the more external I have termed the retinogen because from it arises the retinal elements; the other, from analogous reasons, is the gangliogen. So far the account is closely similar to that of Locy as outlined above. I have, however, been able to trace the development of all the parts of the adult eye, which in outline is as follows. The cells of the gangliogen elongate and each divides, giving rise to a row or series of cells which grow upwards toward the mathematical center of the eye and produce the chain of ganglia and nerve fibers which lie in the stalk of the adult eye. In a somewhat similar way the cells of the retinogen elongate and divide transversely, each giving origin to five cells which also lie in a radius of the eye. Of these the outer forms the retinophora of the figure above while the others develop into the pigment cells. All of the structures embraced in the bracket *rg* in the figure are hence derived from the retinogen, while from *g* inward until connection is made with the cerebral portions all is of gangliogenous origin; the space between the two indicates the position of the cavity of the invaginated pouch. In the adult it is filled with

pigment, connective-tissue and nerve fibers. The latter grow out from the ganglion, the others are of mesoblastic origin, and force their way into the cavity at about the time when the cells of its walls begin to elongate. The crystalline cone is plainly formed by the walls of the retinophora and these same cells can also be seen to elongate and unite to form the pedicel, thus clearly demonstrating the truth of Patten's position and the error in Grenacher's conception of the rhabdom. I hope soon to publish a detailed account of my results with figures which will make clear all the points indicated above.

This development of the compound eye from a single invaginated pit shows conclusively that this organ could not have arisen from a confluence of ocelli, but must have had its origin from the division of a simple eye in some respects like that of a spider. Farther, the close correspondence observable in the development of the eye of a spider and that of a crustacean, as outlined above, and the difference of both from that of Peripatus and the ocelli of Hexapods, go far toward sustaining the position I took last year (Inter-relationships of Arthropods, this journal, XIX, pp. 560–567; and Embryology of Limulus, Quart. Jour. Micros. Sci., XXV, pp. 521–576) that the group Tracheata is not a natural one, and that the spiders are far more closely related to the Crustacea than they are to the Hexapods, with which they are usually associated.

At the same time the structure of the eye in the adult Peripatus does not at least conflict with another point I suggested in the paper in the AMERICAN NATURALIST just quoted, *i. e.*, that Peripatus, in spite of its tracheæ, is not an Arthropod at all. To be sure it arises by an invagination, but so does that of cephalopods and, in a modified way, those of vertebrates. We know almost nothing of the development of the eyes of other groups, but the almost perfect similarity shown between the eye of the adult Peripatus as figured by Balfour and that of the syllid worm Autolytus as it is seen in my own preparations—a similarity extending to almost every detail—renders it a not very rash step to predict that invagination will be found to play a part in the development of the annelid eye as well.

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— Nearly every one knows that the natural process of learning nature is the reverse in its order of the system on which nature has been built up. The primitive stages of creation are difficult of observation, and in many cases belong to past time. It is the completed results which first obtrude themselves on our observation, and which attract our attention by their beauty and other remarkable characteristics. It is the desire to possess in its storehouses these varied objects, the wish to classify them in some manageable form, which generally actuates the mind in its first excursions into the field of natural history. Even when the young naturalist has the ulterior object of seeking the origin or *modus vivendi* of visible nature, he feels the necessity of becoming acquainted with the species themselves before he can satisfactorily determine their deeper or more concealed qualities. Hence the natural order of acquisition of a knowledge of nature begins with species, and some rational classification of them, before it enters on the ultimate elements, organic or chemical, which compose them.

These remarks are *apropos* to the method of teaching the natural sciences. We venture the assertion that the number of students of nature which have approached it from the side of histology, or even of organology, is small. Interest in the subject is progressive, beginning with the superficial, which is the most simple, and ending with the more profound, which while simplest from the point of view of creation, is more complex in its mental implications. Few minds in their early stages can remember or take much interest in the details of the ultimate analysis or dynamics of nature, since they are difficult both of observation and of mental apprehension. The powers of observation are developed before those of ratiocination, and they lead the growth of the mind of the average person.

The first lessons in natural history should consist of simple and obvious exercises in classification. The natural orders of plants and of insects are especially adapted (with some exceptions) to this stage. They are concise, easily observed and clearly defined. Material is abundant. Many systems of genera are equally good, as those of fresh-water shells and of ferns. The eye-tests for minerals are the natural introduction to mineralogy. We condemn

without hesitation any system of education which commences, as nature commenced, with microscopic objects, and with processes which are as yet unclassified. The thirst for the unknown will develop, and it should be led along by a process of satisfaction before it is brought to that frontier line where all the resources of knowledge and method are necessary to progress.

—— The earthquake which visited the eastern part of North America on August 31st is one of the most remarkable in our history, both in its extent and in its serious results to the south-eastern portion of the country. Its occurrence naturally excites inquiry as to the possibility of our being more frequently visited than heretofore by this scourge. The numerous earth-trembles common to all countries are of little moment, but against such destruction as has visited Charleston we must, if possible, provide.

It is well known that there are lines of abrupt change of the geological structure of the earth's crust, which are known as faults. These are more or less elongated fractures, on one side of which the strata occupy a much higher position than they do on the other. The depressed side may not receive deposits of much thickness subsequent to the fracture. If in this case the elevated side is not removed by erosion, a range of monoclinal mountains is the result. If on the other hand deposits are laid down on the depressed area, and the elevated tract is mowed down by "frost and fire," the mountain range disappears and none but the geologist can detect the fault or fissure.

The shrinkage of the earth is supposed to have been the cause of the elevation of many mountain ranges, which are wrinkles of the surface. In the formation of these wrinkles faults often occur. In the formation of the greatest changes of surface they are nearly always produced. Such abrupt changes of structure occur at or near the sea-borders of most continents. The depressed region is occupied by the sea, and by the deposited material which flows into it from the shore.

Such a line of fault extends throughout the Eastern United States. It commences at the sea-coast at Staten island and extends south-west near to Trenton, Philadelphia, Wilmington, Del., Baltimore, Washington, Richmond, Raleigh, Columbia S. Ca., etc. This is a very important line in the economy of the country. Here the hill-country ceases and the plain of the sea-board begins. In many of the States it marks the head of tide-

water and of navigation. It is here that the most important cities of our Atlantic States have been built. The presence of water-power or of tide-water, or the conjunction of both, has determined their location. Other conveniences make them desirable dwelling places. Such is the equal accessibility of the fruit and vegetable products of the plains with the grazing and dairy products of the hills. Such the equal accessibility of sea-shore and elevated places of summer resort. Professor Cope pointed out this interesting geological position of our Eastern cities several years ago.

The position has, however, the disadvantage of being on the line of fracture of the border of the continent. This line is the hinge on which the flatter region of the coast has in past geological ages moved up and down. Many times this region has been submerged, and as many times it has been elevated above the sea-level. More than half of it in the latitude of New Jersey, that is, a width of one hundred miles, is submerged at the present time. Its sea-border from New Jersey to Florida has been slowly creeping westward, since observations began to be made on our coast. The most exact of these observations have been made by Professor Geo. H. Cook, on the coast of New Jersey. Geologists know that the present state of affairs is not a permanent one. There is no reason to doubt but that the line of fracture referred to may not again become the coast-line, or on the other hand that the width of our coast-region may not be extended one hundred miles out to sea. The plains of this region will then be submerged or elevated. In the former case if the process be rapid the loss of life will be great. But it will probably be slow, with occasional slips of one side of the old faults on the other, which will jar the rocks over large areas. Under these circumstances there is no reason to suppose that our region can continue to be exempt from earthquakes. We are to expect periods of repose alternating with periods of disturbance.

—— It is of importance to science in this country that the aid furnished by the Government to its scientific bureaus should be continued. In the present humor of Congress there is some risk that the appropriations for the U. S. Geological Survey may be seriously reduced. For such a result the science of the country will hold the present management of the survey responsible, unless the charges of incapacity and plagiarism now freely made against some of its members can be satisfactorily proven to be false. Such charges should be disposed of, or if true should lead to the discharge of the persons implicated from the employ of the Bureau.—*C.*

RECENT LITERATURE.

THEODORE H. HITTELL'S HISTORY OF CALIFORNIA.[1]—Among the recent publications of the Occidental Publishing Company of San Francisco, are the two volumes of Hittell's History of the Gold State, which by their peculiarly fascinating style will not fail to attract a large number of readers. Volume I comprehends within the compass of 800 pages the period of discovery, the successive epochs of Spanish domination, and winds up with the overthrow of these foreign lords in Mexico and all its adjacent territories, the last date referred to being the year 1822. The more important names in the history of Pacific coast and Californian discovery are all familiar to us: Cortez, Ulloa, Cabrillo, Drake (who anchored under Point Reyes), Cavendish and Vizcaino. An historic subject which stands in no necessary connection with the main contents of Hittell's work, but is introduced here in attractive form, is the settling of the peninsula of Lower California, its Jesuit missions and Indian population. The importance of that arid and prosaic stretch of land was bound to decrease as soon as Alta California, the present State of that name, with its more promising features, began to attract the attention of the world. The *real* history of California begins, not with the expeditions of the discoverers, but with the missions established under the prudent and energetic leadership of the Franciscan Father, the celebrated Junipero Serra. After organizing and administering a number of coast missions, from 1769 to the time of his death in 1784, Serra found successors who endeavored with varying success to continue his work of christianizing the natives. Of the purely civil settlements started in the new country, San José, founded in 1777, was the earliest. The viceroy Bucareli also continued the exploration work along the Pacific coast by sending out three expeditions (1774, '75, '79). North of St. Rafael and Sonoma no missions were established by the Franciscans; their work survived the war of Mexico's liberation from the Spanish supremacy (1820) by fourteen years, when they were secularized by the republican authorities of Mexico. "Treason on the side of the clericals," says Hittell, "and spoliation on the other part, were contributory in bringing about this secularization," and the ruin of the Californian missions was unavoidable. The Indian neophytes had never become self-sustaining, and thus the majority of them scattered in all directions. The establishment of the twenty missions had rested upon a false moral principle, and hence no practical result of their existence is now apparent. The Californian missionaries' work remained barren of results, "because it looked only to the aggrandizement of a system and dominion that had long outlived their usefulness, and

[1] *History of California.* By THEODORE H. HITTELL. Two volumes. San Francisco, Occidental Publishing Company. Octavo.

did not contemplate or in any proper sense regard the progress of true civilization" (p. 508).

In 1787 the two Californias had become united with Sonora, New Mexico and New Vizcaya into a "comandancia jeneral" of the "four internal provinces of the West;" the governors removed from Loreto to Monterey. The biographic sketches presented of each of the governors from 1767 to 1820 are highly interesting, and gives us a curious insight into Californian social life as it was a century ago; they were Portolá, Barri, de Neve, Fages, Romeu, Arrillaga, Borica, Arrillaga again, Arguello the Elder, and Sola, whose rule was ended by the war of Mexican independence.

The three concluding sections of Vol. I are devoted to the passive element in the great drama of colonial history (in which the *gente de razón* seemed to be the only motors); the Indians, their exterior, customs and manners, settlements and languages. No classification of them after scientific (racial or linguistic) principles was attempted, although we have had dates enough to do this for the last ten years; but a profusion of ethnographic details gives a graphic idea of what the Indians were in those times. In the description of their mythology too much prominence is given to Father Boscana's report, whose tribe at San Juan Capistrano, on the coast, formed a small portion of the aborigines only, and is by no means typical, for the Shoshóni race to which they pertain is an intrusive people coming from the "Interior Basin" (Nevada, Utah, Idaho, Wyoming). Among the old and real Californian Indians we have to count the Yuki, Wintún, Maidu, Mutsun, San Antonio and Yókats tribes; on the northern State border the Hupa, Lassic and Sáyar are intruders also. A historian cannot be a specialist in everything, and thus we can condone such misstatements on Indians as we find in Vol. I, pp. 797 and 798.

The second volume begins with the administration of the country under the republican Mexican governors. Their names were as follows: Arguello the Younger, Echeandia, Victoria, Pio Pico, Figueroa, Castro, Gutierrez, Chico, Gutierrez again, Alvarado, Micheltorena, Pio Pico again. Then follows the American conquest of the country in 1846, and the pressure of immigration consequent upon it. The chief actors in this new process of settlement, Sutter, John C. Fremont, Kearney, Sloat, Mason and the relations of this latter military commander with Pio Pico are now engrossing our attention, while the hardships of the adventurers' traveling over the plains to California, especially the terrible fate of the Donner party, which perished in the Sierra Nevada during the winter of 1846 to 1847, arouse our feelings of compassion.

The momentous results of Marshall's gold discovery at Coloma, in January, 1848, did not follow immediately after that act (p. 684); it was not before March 25 that a San Francisco

newspaper made the statement that gold dust had become an article of traffic at Sutter's fort; but on May 29 the "Californian" had to suspend publication in that city, for all the compositors and printers had run off to the new Eldorado. The American troops having been disbanded, most of the soldiers also went to the gold fields, and in the absence of police, insecurity took hold of the coast regions. The yield of the precious metal had become so bountiful that one miner in May, 1848, once averaged twenty-five dollars a day for sixteen days. The volume concludes with the organization of California as a State and its adoption into the Union by Congress; the bill was approved and signed by President Fillmore on Sept. 9, 1850. Separate chapters deal with the social life of that country and its physical aspects, as geography, geology, botany and zoölogy.

Mr. Hittell has made conscientious use throughout of the original documents at his disposal, and invites scrutiny by frequent quotations, especially from the State archives and Junipero Serra's biographer, Palou. His style is as free from cumbersomeness as it is from dryness or obscurity; everywhere we perceive a striving after authentic information and historic truth. It is to be hoped that the author will in a third volume bring the history of the State down *to our own days.—A. S. Gatschet.*

PACKARD'S FIRST LESSONS IN ZOOLOGY.[1]—In addition to the two text-books on zoölogy which he has already written, Dr. Packard has now prepared a third, which is intended as an elementary course for very young pupils. The "First Lessons" ought to be used supplementary to the study of specimens, and should not be used without them.

The plan of the work seems to be well carried out, and the book will prove a valuable addition to the number of text-books already in use.

The author has possibly over-estimated the powers of those for whom his book is written. It ought properly to be made even more elementary than it is, to be brought to the comprehension of young pupils. To adapt the book for younger scholars the author suggests certain omissions, which the teacher may advantageously follow.

The book may well be used in combination with a well-chosen "epitome collection" or "synoptic collection," but always subordinate to the study of nature herself.

We should have preferred, in a text-book of this kind, a larger proportion of figures of those common animals which the pupil can find daily, and an omission of the cuts of several animals which many naturalists have never seen and which the largest museums do not possess.

[1] *First Lessons in Zoölogy.* Adapted for use in schools. By A. S. PACKARD. New York, H. Holt & Co., 1886. 12mo, pp. 290. $1.00.

The author is over-sanguine when he says in the preface that "no boy or girl should leave school without at least as much knowledge of the life about us and of our relations to the animal world as should be found in a book of this sort."

There are several statements in the text which should be modified or changed, and one or two figures which ought to disappear in subsequent editions.

A revision of the glossary would greatly improve the book.

The introduction of many names of large groups of animals without any other notice, and fragmentary mentions of others, may require explanations from the teacher if the pupil is expected to master the book.

On the whole the "First Lessons" is one of the best text-books of its kind with which we are familiar, and will doubtless prove of great service in those schools where it is used.

The book gives a good picture of the science of zoölogy. There is a great amount of information in its pages, and the text is clear and concise. The language is free from technicalities, and the figures as a general thing well chosen.—*J. W. F.*

STUDIES FROM THE BIOLOGICAL LABORATORIES OF THE OWENS COLLEGE.[1]—The biological department of the Owens College, Manchester, England, under the able direction of Professor A. Milnes Marshall, has just published the first volume of its "Studies." It contains reprints of several articles by the professor and his students as well as some which are new. Among these latter are Mr. Marshall Ward's paper on an aquatic Myxomycete found growing on the roots of hyacinths; Mr. A. Dendy's paper on the regeneration of the visceral mass in Antedon; and Mr. C. F. Marshall's studies of the physiology of the nervous system of the lobster.

RECENT BOOKS AND PAMPHLETS.

Amer. Asso. Adv. Sci.—Proceedings of the A. A. A. S., 34th meeting, held at Ann Arbor, Michigan, Aug., 1885. From F. W. Putnam.

Montgomery, E.—The Substantiality of Life.

——Ueber das Protoplasma einiger "Elementar-organismen."

——Zur lehre von der Muskelcontraktion. 1881.

——Causation and its organic conditions.

——The dependence of quality on specific energies.

——The unity of the organic individual I, II. Extract from "Mind." All from the author.

Froriep, A.—Zur Entwickelungsgeschichte der Wirbelsäule. I. Beobachtung an Hühnerembryonen. Ext. Arch. f. Anat. & Phys.

——Beobachtung an Säugethierembryonen. Ext. idem. Both from the author.

Albrecht, P.—Ueber die morphologische Bedeutung der Penischis Epi- und Hypospadie des Menschen. 1886. Ext. Biologische Centralblatt.

——Sur la non-homologies des pneumons des vertebrés pulmonés avec la vessie natatoire des poissons.

[1] *Studies from the Biological Laboratories of Owens College.* Vol. I, pp. 328, fourteen plates, 1886.

Albrecht, P.—Anatomische Schriften des Professors Paul Albrecht.

——Zur Zwischenkieferfrage. Ext. Fortschritte der Medicin, 1885.

——Ueber die morphologische Bedeutung der Pharynx-divertikel, etc., etc. Sep.-abd. d. 14ten Cong. d. deut. Gesellschaft für Chirurgie, 1885. All from the author.

Wilder, B. G.—Anatomical technology as applied to the domestic cat. 1886.

——Address at the unveiling of the statue to Louis Agassiz. 1885.

——Experiments antagonizing the view that the serrulæ (serrated appendages) of Amia are accessory respiratory organs. 1885.

——The paroccipital, a newly-recognized fissural integer. Ext. Jour. Nervous and Mental Disease, 1886. All from the author.

Horn, G. H.—A monograph of the species of Chrysobothris inhabiting the United States. From the author.

Allen, H.—The mechanism of joints. Ext. Trans. Inter. Medical Congress, 1876. From the author.

Cope, E. D.—The Vertebrata of the Swift Current Creek region of the Cypress hills. Ext. Ann. Rep. Geol. and Nat. Hist. Surv. of Canada, 1885.

Museo Nacional do Rio de Janeiro.—Archivos do Museo Nacional do Rio de Janeiro, Vol. VI, 1885. From the Commissao de Redaccao.

Wheeler, G. M.—Report upon the Third International Geographical Congress and Exhibition at Venice, Italy, 1881. Washington 1885.

——Facts regarding the principal government surveys of the world. 1885.

——Facts regarding the origin, organization, administration, functions, history and progress of the government land and marine surveys of the United States. Washington, 1885.

Whitfield, R. P.—Brachiopoda and Lamellibranchiata of the Raritan clays and greensand marls of New Jersey. 1886. From Geo. H. Cook, State geologist.

Herdman, W. A.—Report upon the Tunicata.

Theel, H.—Report upon the Holothuroidea. This and the preceding from The Voyage of H.M.S. *Challenger*. Zoölogy, Vol. XIV, 1886.

Harrison, J. B.—The Adirondack forest. From the author.

Stefanescu, G.—Annuaire du Bureau Geologique de la Roumanie 1882–83. From the director.

James, J. F.—The geology of Cincinnati. Ext. Proc. Cincin. Soc. Nat. Hist., 1886. From the author.

Morris, C.—On the air-bladder of fishes. Ext. P. A. N. S., 1885. From the author.

Nat. Acad. Sciences.—Biographical memoirs, Vol. II, 1886. From the academy.

Dollo, M. L.—Première note sur les Cheloniens du Bruxellien (Eocène moyen) de la Belgique. Ext. Bull d. Mus. Loy. Belg., 1886. From the author.

Shufeldt, R. W.—Osteology of *Conurus carolinensis*.

——A Navajo skull. Both from Jour. Anat. and Physiology.

——Science and the State. From Mind in Nature, Vol. XX, Feb., 1886. All from the author.

Woodward, A. S.—The history of fossil crocodiles. Rep. Proc. Geologists' Asso., Vol. IX.

——On the palæontology of Notidanus. Ext. Geol. Mag., May, 1886. Both from the author.

Gage, S. H.—Address to the Section of Microscopy A. A. A. S., Ann Arbor meeting.

——Notes on the anatomy of Necturus. Rep. Proc. Amer. Soc. Micros. 1885.

Gage, S. H., and Gage, Susanna P.—A contribution to the physiology of respiration in vertebrates. 1886. From the authors.

Townsend, C. H.—An account of recent captures of the Californian sea-elephant. Ext. Proc. U. S. Nat. Mus. 1885.

Meyer, O.—Observation on the Tertiary and Grand Gulf of Mississippi. Ext. Am. Jour. Science, July, 1886.

Meyer, O., and Aldrich, T. H.—The Tertiary fauna of Newton and Wautubbee, Miss. Ext. Cincin. Soc. Nat. Hist., 1886.

Renevier, E.—Rapport sur la Marche de Musée Géologique Vaudois en 1885. From the author.

Dobson, G. E.—Note on the mandibular dentition of the shrews. Ext. Jour. Anat. and Phys., Vol. XX.

Frazer, P.—General notes on the geology of York county, Pa., 1886.

——The application of composite photography to hand-writing and especially to signatures. 1886. Both from the author.

Beyer, H. G.—A study of the structure of *Lingula* (*Glottidia*) *pyramidata* Stim. (Dall). From the author.

Gill, T.—An account of the progress of geology in the year 1885. From the author.

Mackay, A. H.—Notes on the fresh-water sponges of Nova Scotia. 1886. From the author.

McConnell, R. G.—Geological and topographical map of the Cypress hills, Wood mountain and adjacent country. From A. R. C. Selwyn.

Holbrook, M. L.—Studies of the development of the cartilage in the embryo of the chick and man.

——First development of the muscle in the embryo of the chick and man. Both Rep. Proc. Soc. Amer. Micros., 1885. Both from the author.

Merriam, C. H.—Description of a new species of Aplodontia (*A. major*). Ext. Ann. N. Y. Acad. Sci.

——Description of a newly-born lynx. Both from the author.

Marcou, J. B.—Annotated catalogue of the published writings of C. A. White. 1885.

——:o:——

GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ASIA.—*The Aralo-Caspian basin.*—M. Moushketoff believes that the Amu-daria may once have joined the Sir-daria before entering the basin of the Aral and Sary-kamysh lakes; but later on the Amu entered the Sary-kamysh or western part of the double lake, while the Sir-daria flowed into the Aral part. Gradually the Amu, as appears by the orography of the region, undermined the Sultan-uiz-dagh hills, and finally, finding its way through them, entered the Aral. The Sary-kamysh, deprived of its water, rapidly dried up. The bed of this lake is fifty feet below that of the Caspian, and covers a surface of 4400 square miles. The Aral is now also rapidly receding. The Albughir gulf has disappeared, the Sary-cheganak gulf is converted into a lake as is also the Kamyshlybash, which the Kirghis remember to have been connected with the Aral. The evaporation at Astrakhan exceeds the rainfall by five times, at Tashkend by three times, while at Nukus it is twenty-seven and at Petro-Alexandrovsk thirty-six times the rainfall. The Uzboy is, by M. Moushketoff, believed to be a marine outlet which connected the Caspian and

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

Aral basins; it has no river deposits, and Caspian shells extend far up it. Our author classes the sandhills into dunes—river dunes and lake dunes, formed by the combined action of wind and water, and *barkhans*, formed by wind only, and always crescentic or hoof-shaped.

Asiatic News.—The curious and almost inaccessible country of Dardistan and Shinoki, on the Upper Indus, peopled by Aryans who have embraced Sunni Mahommedanism, was traversed in various directions by Ahmad Ali, a sub-surveyor. His laborious journey is described in the Annual Report of the Indian Survey for 1883–'84, but scarcely, according to the Marquis of Lorne, with the prominence it deserves.——Although M. Needham met with no rivers answering to the Sanpo in his recent journey to Rima, so that it seems almost certain that the Sanpo must turn south much farther to the west, must, in fact, be the Dihong branch of the Brahmaputra, the question is not yet settled by actual exploration. The Dihong, at the highest point reached, flows through precipitous gorges in one of the most rugged countries of the world, peopled by fierce and independent mountain tribes.——The Indian Survey Report for 1883–'4 contains a detailed account, with map, of Lake Palti or Yamdok-cho (said to be ring-shaped with a central island), in Southern Thibet. The agent of the survey has made a complete circuit of the lake, and has proved that the supposed central island is a peninsula, separating two bays. Yamdok-cho means scorpion, and these two bays form the claws. The lake lies on the road between Shigatze and Lhasa, at an altitude of 13,800 feet. It is embosomed by mountains except at its eastern extremity, where the heights die away into a verdant plain, on which thousands of cattle and horses graze. Villages and monasteries are dotted around the small bays of the shores.——Explorations in the Himalayas have brought to light the large Lhobra river, which has been traced to within a day's march of the Bhotan frontier. A native surveyor completed the circuit of Kinchinjinga, so that the boundary between Northeastern Nepal and Thibet can now be delineated.——Dr. Gottsche, who on behalf of the Japanese government has traveled widely over Corea, visiting eighty of the 350 district towns, states that granite, gneiss and crystalline schists are predominant in the geology of the peninsula. Here and there they are broken by the older volcanic formations. Palæozoic strata occur rarely, and the later sedimentary formations not at all (?). The only metal in which Corea is rich, is iron. The fauna is extensive and interesting from the fact that palæarctic and sub-tropical types meet here.——From a communication by M. Nikolsky to the St. Petersburg Society of Naturalists, it appears that Lake Balkash is drying up, the lowering of the level amounting to two feet in ten years. Maps of 1852 prove that since that time a great reduction of surface has taken place. The

fauna of this lake does not include a single species of fish which characterizes the Aralo-Caspian region; while there is great resemblance between the fishes of Lake Balkash and those of the high plateau of Central Asia. There was certainly, in recent geological times, a connection between the rivers of the Balkash basin and those of the Lob-nor basin.

AMERICA.—*American News.*—Mr. Whitely has ascended Twekkway, a table-topped mountain in Guiana, situated about fifty miles N.N.W. of the now celebrated Roraima on the southern bank of the Carimang river, below its junction with the Araima. The mountain is not so high as Roraima but similar in form, with vertical walls and a long sloping talus uniting the cliff to the savanna country below. Unlike Roraima it is wooded at the summit, the foot-slope at one part gives easy access to the top, and the water which falls upon it instead of falling in cascades over the edge of the plateau, drains off by a cavity of great depth in its center.——Petermann's Mittheilungen publishes an account of the exploration of Dr. F. Boas in Baffin land in 1883–4. The object of the expedition was mainly ethnographical, but the extensive sledge journeys taken along the coast have enabled him to add considerably to our knowledge of the configuration of the coasts of Cumberland sound and Northeastern Baffin land. Important alterations will have to be made on existing maps, and the coast-line around Home bay is for the first time delineated. Many terraces, which Dr. Boas calls moraines, were met with in Northeastern Baffin land. His notes embrace all the phases of Eskimo life, their dialects and religion. The people of Baffin land are classed in seven divisions. These people always settle where there are extensive ice-plains.

AFRICA.—*Mr. Farini's Journey in the Kalahari.*— The July number of the Proc. Roy. Geog. Society contains an account of a recent journey in the Kalahari desert, by G. A. Farini. This desert forms the western portion of the new British protectorate of Bechuanaland, and has been but little explored. Its southern portion, immediately north of Griqua land, is occupied by half-breeds who suppressed or exterminated the Koranna Hottentots and received this land as a reward. Mr. Farini declares that the ordinary idea that all Bushmen are dwarfs is incorrect. Some that he met with were above the medium height. They live in caves, the walls of which are adorned with drawings. The sand-hills of the Southern Kalahari have their slopes covered with grass, but water is very scarce. The *sama*, a small gourd, is eaten by the oxen, and aids them to dispense with water for a considerable time. In the dry pans water can be obtained by digging. The Vaalpens obtain water by sucking a reed driven down some five feet below the surface. The water courses are dry, but are marked by a line of green. Wheat, sown in the rainy season,

will, at Kais on the course of the Molapo, mature in the dry season without irrigation. The Kattea are a nomadic tribe much like the Bushmen, but live in huts made of sticks set in a half circle, bent forward and covered with grass and milk-bush. The men are nude, the women clothed in a bit of skin. The Vaalpens are vassals of the Bechuanas, and in turn enslave the Kattea and Bushmen. The tribes on and bordering the desert practice circumcision at the age of sixteen, sometimes with fatal consequences.

Lehuhitung has a population of several hundred Bakalahari, a cross between Matabele and Bechuanas.

Near the Ochimbinde river, south of Lake Ngami, a thick forest was met with. Lake Ngami is becoming shallower every year on account (according to our traveler) of the gradual rising of the country. Griqua land is also rising. A tribe of dwarf Bushmen, called M'Kabbas, was found west of the lake. None exceeded four feet eight, and the women were as tall as the men. After reaching the watershed north of Lake Ngami, our traveler turned back, taking a more westerly route, but everywhere found the Kalahari not a barren waste but a sandy tract clothed to a large extent with grass and with k'gong trees (a species of mimosa) scattered about. The red sand at Mier is very fertile. Here are the headquarters of Dirk Vielander, a half-breed who claims a large tract north of Koranna land. Mr. Farini reports the discovery of a variety of giraffe with white spots instead of dark, and much taller than the common kind.

While hunting, a huge elliptical walled enclosure of cyclopean masonry was found in about 23½° S. lat. and 21½ E. long. Basin-shaped ovals, sometimes formed out of one rock, sometimes composed of several, were regularly distributed every few yards round the ellipse. In the middle of the enclosure was a cross-shaped pavement of long narrow blocks, in the center of which was what seemed a base for a pedestal or monument. A broken column, with four flat fluted sides, was found, but no inscriptions could be discovered.

The falls of the Orange river, before pronounced inaccessible, were also visited by our traveler. The river is broken up at low water into many streams by projecting rocks, but in flood season many of these join into a sheet rivaling that of Niagara. At low water there are several smaller falls 350 feet high, and a main fall (the Hercules) 165 feet high.

The Kalahari is a plateau 3000 to 4000 feet above the sea, with an average summer heat of 80° during the day. The nights are cool. The average winter temperature is 60°. It is perfectly healthy for Europeans. In the discussion which followed, Mr. M. Kerr declared that Sr. Farini must have traversed the country at a propitious time after a rainfall.

The Congo.—The Rev. G. Grenfell continues to explore the Congo tributaries in the steam launch *Peace*. The Itimbiri was found to be navigable as far as the Lobi falls (23° 21′ E. long. and 1° 50′ S. lat). The Mbura divides into two at three or four miles from its junction with the Congo, and both branches are barred by rapids or falls, the southern one having a cascade forty feet high. The Lomami is a fine river with a tortuous channel and a swift current. In August, 1885, the Lulongo was ascended for nearly 700 miles. Its principal affluent is the Lopori, in 1° 12′ N. lat. The Juapa and Bosira form Stanley's Black river, which enters near the equator. The Juapa was navigated for about three hundred miles, but hostile natives compelled the explorers to retreat before reaching the head of navigation. The Bosira was navigable for about two hundred miles. Mr. Grenfell dwells upon the richness of the Upper Congo basin.

Herr Wolff, a traveler in the service of the Congo Free State, has discovered an affluent of the Kassai likely to be of great future importance. This was ascended by the steamer *Vorwarts* in February and March to a distance of 430 leagues from its mouth, and one of its northern affluents brought the traveler to within a week's march of Nyangwe. There were no cataracts, and the stream might have been navigated still further had not the steamer met with an accident. By this route the great northern bend of the Congo, with its cataracts, can be avoided and an easy passage traced across Africa.

African News.— According to the observations of MM. G. Valdall and K. Knutson, the Rio del Rey, which forms the boundary between the English territory on the Niger and the German colony of the Cameroons, is not a river, but rather an estuary, the north-eastern arm of which is the Mene, while the northern arm is connected with the old Calabar river.——Father Duparquet, of the Péres du Saint-Esprit mission, has founded a station upon the plateau of Amboella, in 15° 8′ S. lat. and 16° 14′ E. long., at an altitude of 4540 feet, on the right bank of the Okashilanda, a tributary flowing into the Cunene on its left bank. M. Duparquet gives information about the Kuerahi and the Kavundu, which flow between the Cunene and the Okavango. The former of these two rivers, hitherto unknown to Europeans, crosses the territory of Evare, at the extremity of which it forms a lake.——Mr. Cope Whitehouse has, with the assistance of Herr Stadler, an engineer in the Egyptian service, thoroughly surveyed the Reian basin. The total area of the depression is estimated at 232 square miles, with a maximum depth of 280 feet below the Upper Nile. The possibility of utilizing these basins for storing the waters of the Nile seems to be interesting the Egyptian public. The Khedive has lent his aid to the enterprise, and General Scott-Moncrieff, Director of Public Works, proposes to estimate the cost of a canal from the basin to the

Nile.——M. A. Aubry has contributed to a recent issue of the Revue Scientifique an interesting account of his mission to Shoa. His description of the country is rose-color, but the ignorance of its inhabitants is darkly painted. The King believed that his visitor, being an engineer, could make a sword by putting some magic powder into the furnace along with the iron, a chief asked him for a charm against fire; and the people generally, seeing so many things that came from Europe, and not being acquainted with tools or processes, believe that all Europeans have a compact with the devil, and manufacture articles with their hands alone.

EUROPE.—*European News.*—There are, according to Professor Heim, 1155 glaciers in the Alps. Of these, 249 exceed 7500 meters in length. The total superficial area is more than 500 square miles. France has 144, Italy 78, Switzerland 471 and Austria 462. The Aletsch glacier, in Austria, is the longest. ——From a discussion (St. Petersburg Society of Naturalists) upon the steppes of Russia as compared with those of Hungary and Spain, it appears that the steppes between the Pruth and the Don, like those of Hungary, support agriculture without irrigation, while those beyond the Don and the Volga are more truly Asiatic in character. The desiertos of Spain are more akin to the deserts of Africa than to the steppes of either Central Asia or Europe. The absence of forests was referred (1) to the salt-clays which covered them after their emergence from the sea; (2) to the ruminants which resorted to the steppes when grasses appeared, and (3) to the burning of the steppes by man.——The journey made to Cape North by Srs. Sommier and G. Cini, in January, 1885, is interesting as the first made across Lapland and Finland in midwinter for purely scientific purposes. The goal was reached from Magerö, the northernmost inhabited point, on foot, with comparative ease. Besides the eider and other water fowl, the raven, crow, magpie, Arctic fox and francolin (*Lagopus mutus*)—the last everywhere abundant—were seen. Much valuable information was collected on the Lapps, Quäns, and Northern Finns.——Recent soundings have given the following depths for the Swiss lakes: Constance, between Uttwyl and Friedrichshafen, 255 meters; Geneva, between Rivaz and Saint-Giugolphe, 256 meters; and between Lausanne and Evian, 330 meters; Lucerne, between Gerau and Lueteren, 214 meters; Brienne, 261 meters; Thun, 217; Zug, 198; Neuchatel, 153; Wallenstadt, 151; and Zurich, 143 meters.

GEOLOGY AND PALÆONTOLOGY.

THE PERMIAN IN NEBRASKA.—The question has been raised whether there is any true Permian formation in America, but pending its final solution I use the term provisionally to designate a group of strata found along the valley of the Blue river in Gage county,

Nebraska. This group is distinguished from the underlying coal measures by the absence of coal and black shales, by the prevailing magnesian character of its limestones, by the presence of certain characteristic indurated marls and oölytic limestone, as well as by the new and distinct types of animal life. The limestones are buff, yellow or blue, full of geodes, large irregular cavities and chert.

There are some indications of unconformity between the coal measures and the Permian, but further investigation is required on this point. The Permian itself varies in dip at different localities. Along the Blue river, from Beatrice to Holmesville, the dip is south-east; along Indian creek, from Wymore to Odell, it is west. These determinations were made by myself in 1885, and during the present year Mr. W. C. Knight obtained the same results. The total thickness of the Permian is not less than two hundred feet. Exact determination of the thickness can not, however, be made until the dip has been more fully determined. There is decided unconformity by erosion at the top of the Permian. The overlying Dakota group of the Cretaceous period occupies the hollows which were cut into the Permian during the long period in which Triassic and Jurassic strata were forming in other parts of the continent, this region having been a land surface at that time.

A valuable collection of the fossils of this formation has been made by W. C. Knight, and was displayed at the Buffalo meeting. Among the characteristic new types were a gigantic Pinna and a fine cephalopod intermediate between Nautilus and Ammonites. Besides the presence of types undoubtedly new and approximating Mesozoic forms, the great diminution of typical Carboniferous species is noteworthy. Of 123 species enumerated by Meek from the coal measures along the Missouri river in Nebraska, not more than a dozen run up into the Permian. As the Permian is only a subdivision of the great Carboniferous system, the presence of some common forms is to be expected.

The old maps represent the Permian as extending from the Kansas boundary line north-eastwardly to the Platte river. This seems to be an error, the characteristic rocks and fossils of this formation having been certainly identified only in the valley of the Blue river. The surface exposure of the Permian occurs almost wholly in Gage county, possibly extending a little way into the counties of Lancaster, Saline and Jefferson.

It must be admitted that many of the claims hitherto advanced for the existence of Permian rocks in certain localities, have been ill-advised. But previous errors in the way of confusing coal measure species with Permian species should not be permitted to prejudice any new and valid evidence. If we turn our attention to the course of events in the geological history of the eastern part of the continent about the close of the Paleozoic era, we

perceive that vast physical changes intervened between the deposition of the latest Carboniferous and the earliest Mesozoic rocks. The Appalachian mountains were raised up, and with them came the greater part of the continent east of the Mississippi river and was added to the stable dry land. A gap in the life of the earth as tremendous as the physical change just mentioned, intervenes between the coal measures and the Triassic. These mighty changes in the distribution of land and water, this immense stride forward in the life-history of the earth required a long period of time. Was there no sedimentation, no rock-forming going on anywhere in America during that time? It is highly probable that there was, and the rocks then formed ought to be called Permian, though they may not, in their lithological composition or the fossils they contain, exactly agree with the Permian of Europe.—*L. E. Hicks, Univ. Nebraska.*

The Recent Earthquake in the United States.—For the first time in our history the south-eastern portion of our country has been visited by an earthquake of serious power, which has resulted in great destruction of property and loss of life. The city of Charleston, S. Ca., has been so seriously shaken that it is said that a very large majority of its houses have been rendered unfit for habitation, and at least sixty persons have been killed. The following reply of Dr. J. W. Powell, of the U. S. Geological Survey, to a despatch of Secretary Topley of the British Association for the Advancement of Science, gives a general view of its character:

"The earthquake was the most severe on record in the United States, and affected the greatest area. Its origin was along the line of post-Quaternary dislocation on the eastern flanks of the Appalachians, especially where it crosses Central North Carolina. Slight premonitory shocks were felt in the Carolinas for several days, moderately severe shocks occurring near Charleston August 27 and 28. The principal shock, causing the great destruction in Charleston, originated in Central North Carolina, August 31, at 9.50 P. M., 75th meridian time. Thence the shocks spread with great rapidity in all directions with a velocity varying from twenty-five to sixty-five miles a minute, over an area of 900,000 square miles, or one-quarter of the United States, embracing twenty-eight States, from the Gulf of Mexico, the Great lakes and Southern New England, and from the Atlantic sea-board to the Central Mississippi valley. In the Carolinas it was accompanied by landslides, crevasses, and great destruction of property. Half of Charleston is in ruins, more than forty lives lost. No sea wave yet reported."

There are many phenomena of disturbance in all parts of the region which was shaken most severely. At Summerville and Ten Mile station, near Charleston, and for a great distance along

the coast, there are numerous craters from which mud and water were discharged. Near the Coosaw mines, S. Ca., there is a crack in the earth 200 feet long and six inches wide at the top. On St. Helena island, off Beaufort coast, several large openings were made and piles of mud and sand were forced up. Passengers on the first through train from Charleston to Savannah since the earthquake Thursday, say that holes in the earth resembling wells have opened in the neighborhood of Charleston and for miles along the coast. They vary in diameter, but average two feet. Mica and other minerals not known in that section before, are found around their mouths. Mud of a bluish color oozes from fissures in the ground surrounding them, and the water savors of soda. People living near them report that when the water first burst forth from the ground it was steaming hot and shot fifty feet into the air. On Pac island, near Beaufort, a fissure in the earth, twelve feet wide and 400 feet long, still remains. All the islands in that vicinity report similar fissures, with mud and water issuing from them.

Disturbances are reported from the Black mountains of North Carolina, but nothing of a reliable character has reached us from that quarter as yet. We shall await with interest information from this region, and will hope that some geologist, competent from familiarity with those mountains, may make a detailed investigation of their present condition.

Some comments on the probable cause of the earthquake will be found in our editorial department.

Geological News.— *General.*— The detailed catalogue and guide to the geological exhibits of New Zealand in the Indian and Colonial exhibition, by Jas. Hector, contains a full description of the strata of the islands, with map. The Cretaceous and Tertiary are grouped under the title of Cretaceo-Tertiary.—— The History of Fossil Crocodiles, by A. S. Woodward, gives an account of the order from its first appearance in the Trias to the present time, with notes upon the localities in which the various genera have been found, and a list of genera. In the Triassic Belodon the order seems to have its inception, but this genus has many dinosaurian and lacertilian characters. In Belodon the posterior nares are not displaced backwards as in recent crocodiles, while the Liassic and Wealden crocodiles approach nearer to living forms in this respect.——Mr. A. S. Woodward also reviews the genus Notidanus. No undoubted traces of the genus can be found in beds beneath the Middle Oölite. Twenty-three fossil species, eight Jurassic, four Cretaceous and the others Tertiary, are enumerated.——The Memoirs of the St. Petersburg Imperial Academy of Sciences include extensive studies of Russian fossil reptiles, by W. Kiprijanow. Part III (1883) contains descriptions of Thaumatosauria from the chalk and Moscow Jura, belonging to the genera Polyptychodon, Thaumatosaurus and

Lutkesaurus. Part IV contains various notes on Sauropterygia and some undetermined fossils, and a description of *Pœkilopleuron schmidti*, a crocodilian.——The gneisses and schists of the Sinaitic peninsula, with similar rocks in Upper Egypt, are by Professor Hull referred to the Laurentian. Newer slates and schists with igneous rocks flank these, and are probably pre-Cambrian. The Cambrian, Silurian, and Devonian seems to be unrepresented in this region, the next rock in ascending order being the "desert sandstone" (sandstones, conglomerates and limestones) enclosing carboniferous fossils. Overlying these rocks, which are not very extensive, is the Nubian sandstone, which cannot be distinguished from it by mineral characters, but which seem to be Cretaceous, though it may be Jurassic or Triassic. Above this is the Cretaceous limestone, corresponding in age to the European chalk. This constitutes the mass of the hills in Palestine.—— Dr. Schweinfurth has recently announced, in the Bulletin of the Egyptian Institute for 1885, the discovery of stems of crinoids, and of an Athyris allied to *A. concentrica*, in sandstone hitherto regarded as Nubian sandstone. Thus the lower part of the Nubian sandstone may prove to be Carboniferous.

Carboniferous.—Professor J. R. Jones states that in the Carboniferous formation of Great Britian 170 species of Ostracoda have been found belonging to thirty-three genera and nine families. The Carboniferous limestone of Southwest Scotland, especially the shales of the lower beds, is highly productive of Ostracoda. A great variety of genera and species were from beds at or near the base of the Scar limestone and its equivalents in Northumberland, Cumberland, Westmoreland and North Lancashire. The calcareous shales of the Yoredale series have several interesting forms. The middle coal-measures have five species of Carbonia, Beyrichia one, Philomedes one; the lower have a Beyrichia and a Carbonia; the upper *B. subarcuata*, while the latest Carboniferous ostracod is *Leperditia inflata* in the Spirorbis limestone.

Jurassic.—M. Stanislas Meunier finds four genera (Tigillites, Crossochorda, Equihenia and Eophyton) among the curious fossils, analogous to the Silurian bilobites, collected from the Jurassic beds of Equilien (Pas de Calais, France).

Tertiary.—M. L. Dollo, apropos of the remains of a tortoise found at Melsbrook, near Vilvorde (Belgium) some ten years ago, reviews and mainly adopts the classification of Professor Cope. He proposes the name Thecophora for shelled tortoises, unites the cryptodire family Propleuridæ with the Cheloniidæ, and establishes a family Eurysternidæ. The tortoise in question was taken from the "Bruxellian" (Lower Eocene) beds, and is a cryptodire of the family Chelydridæ. M. Dollo names it *Pseudotrionyx delheidi.*——Mr. R. L. Lydekker, after a reëxamination of the specimens from the bone-bed of the red crag in the

British and Ipswich museums, believes that three species of Mastodon, *M. arvernensis*, *M. longirostris* and *M. borsoni* are represented; that *Hyæna arvernensis* and *H. antiqua* are probably identical with *H. striata*; and that there are two forms of Sus, the larger probably *S. erymanthius* or *S. antiquus*, the smaller *S. palæocherus*. The other quadrupeds are a tapir, more likely *T. arvenensis* or *T. elegans* than *T. priscus; Hippotherium gracile*, and a Rhinoceros, probably the hornless *R. incisivus* (though *R. schleiermacheri* probably also occurred). A species of albatross was also represented.

Quaternary.—M. A. de Lapparent (Bull. d. l. Soc. Geol. de France, 1885, 456) traces the origin of the yellow silicious silt of the plateaux of the Paris basin. He points out that wherever the edge of this bed is seen against a line of heights, veins of small angular flints are seen, and shows that in character the mud exactly resembles that left by melted snow or running rain water—an oxidized mud which has always been in contact with the air. Nowhere else in France does this yellow mud cover so large an extent. It is, M. de Lapparent believes, the impalpable residue of the ancient Tertiary deposits, and its thickness is proportionate to that of those deposits. During the glacial period the flints, alternately subjected to freezing and melting, crumbled to pieces. M. de Mercey, in a subsequent note upon the same subject, shows that the Quaternary gravels were deposited in the water synchronously with the formation of the alluvium at higher levels. When these beds are found superimposed in the terraces of the valleys, the alluvium is not contemporaneous with the gravel it rests upon, but with that at a lower level. M. de Mercey also maintains the distinctness of an atmospheric bed of glacial mud, which was formed by the crumbling of the flints in the manner indicated by M. de Lapparent.

BOTANY.[1]

BOTANICAL WORK OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The recent meeting of the association at Buffalo showed no diminution of the interest taken by botanists in these annual gatherings. The number of botanical papers presented was small but of good quality. It is noticeable that they include no physiological subjects, and that the tendency is strongly toward the systematic side of botany, which may be taken as indicating the prominent position which this phase of botanical science still maintains with the leaders. The following is the list of papers presented:

1. The bulliform or hygroscopic cells of grasses and sedges compared. By W. J. Beal.

These cells are modified epidermal cells which occur in groups

[1] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

upon one or both surfaces of most grass and sedge leaves. Their office appears to be to roll up the leaves when evaporation becomes excessive, and thus reduce the amount of exposed surface. The form and position of the cells is usually characteristic of each species, as was well illustrated by the paper. Charts showing enlarged sections of each leaf enabled the listener to intelligently follow the descriptions.

2. Synopsis of North American pines based on leaf anatomy. By J. M. Coulter.

The author has made a careful and critical study of the value of the histological character of leaves in determining the relationships of the members of this group of plants, and finds them of more service than heretofore recognized. Those especially to be relied upon are the resin ducts, the fibro-vascular bundles and the hypodermal tissues. The value of each is pointed out, and a classification of species given to accord with the results of the study.

3. The development of the Gymnosporangia of the United States. By W. G. Farlow.

The paper embodied the results of numerous cultures carried on in connection with work at the Harvard Cryptogamic laboratory. The spores of the Gymnosporangia were sown upon the leaves of several species of fruit trees, and more satisfactory results obtained than by previous experiments in this line in America. The author is enabled to connect with considerable certainty several species of this genus with as many species of Rœstelia. The investigation has given rise to some troublesome problems which are left for future study.

4. Plan for laboratory work in chemical botany. By Lillie J. Martin.

Miss Martin does excellent service to botany in this country by calling attention to the advantages in studying the chemical constitution of plants as a department of botany. Her paper is particularly devoted to a consideration of the requirements of the student in taking up the subject, even to the matter of desk conveniences.

5. Memoranda of a revision of the North American violets. By Asa Gray.

The paper gives the results of a recent study of all available material, bringing this genus into much more satisfactory shape.

6. A revision of the North American species of the genus Fissidens. By C. R. Barnes.

The author has applied the same critical judgment to this group of mosses that has prevailed among our best systematists when treating of the flowering plants, and the result is undoubtedly of corresponding value. The most important change is the absorption of the genus Conomitrium.

Besides the above a number of papers presented to the association were more or less botanical. A brief reference to them will be sufficient for the present connection.

7. Certain chemical constituents of plants considered in relation to their morphology and evolution. By Helen C. De S. Abbott.

The author maintains that in determining the relationship of plants, their chemical constitution has important claims for consideration, and illustrates the proposition by tracing the occurrence of Saponin and some other substances.

8. Atavism the result of cross-breeding lettuce. By E. Lewis Sturtevant.

This gave a description of several plants of lettuce grown from seed of the previous year's crossing, among which were one or more clear instances of atavism.

9. A study in agricultural botany. By E. Lewis Sturtevant.

The type forms of cultivated vegetables, especially of parsnip, carrot, etc., are shown to be traceable to wild prototypes and not to have originated by human selection. Variation under culture has circumscribed limits.

10. Biology of timber trees with special reference to the requirements of forestry. By B. E. Fernow.

The author reviewed the various influences which affect the growth of forest trees, and pointed out the factors that especially need studying in developing the forest botany of America.

11. Preliminary analysis of a Honduras plant named "Chichipate," By Helen C. De S. Abbot

12. Preliminary analysis of leaves of *Juglans nigra*. By Lillie J. Martin.

13. On the presence of cane sugar and allantoin in ungerminated embryo of wheat. By C. Richardson and C. A. Crampton.

14. Tyrotoxicon (cheese poison); its occurrence in milk and its products, and a method of detecting it. By V. C. Vaughn.

15. Blue milk and ropy cream. By W. McMurtrie.

16. The bacterium of swine plague. By D. E. Salmon and Theobald Smith.

17. The variability of pathogenic organisms, as illustrated by the bacterium of swine plague. By Theobald Smith.

18. The theory of immunity from contagious diseases. By D. E. Salmon.

19. On some Carboniferous wood from Ohio. E. W. Claypole.

20. On the Cretaceous flora of North America. By J. S. Newberry.

THE BOTANICAL CLUB OF THE A. A. A. S.—About ninety registered as members of the club, which is a slightly larger number than last year. The club has proved a vigorous offspring, and shows fair prospect of years of future usefulness. The meetings were held in the room of the Biological section during the hour preceding the morning session of the association, and it is a fact worth noting that although it was inconveniently early, yet the club had a larger attendance than the Section of Biology, with its varied topics and more suitable hours.

The secretary of the club, Mr. J. C. Arthur, being occupied by duties pertaining to the association, Dr. N. L. Britton was appointed secretary *pro tem.* Professor J. M. Coulter was chairman. The meetings were held on Thursday, Friday, Monday and Tuesday mornings, the time being given to short papers,

notes, discussions and the interchange of information on botanical subjects. We may take occasion to reproduce some of the items of general interest in subsequent issues.

The arrangements made by the local botanical club for the entertainment of the club of the association were unusually complete and enjoyable. On Thursday a reception was given to the club at the residence of Hon. David F. Day, which proved a most delightful occasion. Members of the local club had taken much pains to bring, in addition to the hot-house plants, many wild flowers and plants for the decoration of the rooms, and as illustrations of local rarities.

Most of the botanists went to the falls and gorge of Niagara on Saturday, fair weather and ample time giving opportunity for considerable botanizing intermixed with sight-seeing. Monday afternoon a special excursion, by steamer, took the botanists to the Canadian shore of Lake Erie and to interesting botanizing ground.

Altogether the week was a delightful and profitable one; its success lay not only in the fact that the meetings of the club were well attended, but that the several social gatherings were equally so. While the members learned about methods and things, they also gained a knowledge of their fellow-laborers, and imbibed an important element to progressive work—enthusiasm.

The officers for the next year are Professor W. J. Beal, Agricultural College, Mich., chairman, and Mrs. E. G. Britton, New York city, secretary.

Botanical News.—Among the notable botanical papers which have recently appeared, the following may be mentioned: Artificial key to the genera of mosses recognized in Lesquereux and James' Manual of the mosses of North America, by Charles R. Barnes (Bulletin Purdue University, School of Science); A yellow opium mold (*Eurotium aspergillus-glaucus*), by William Trelease (Contrib. Department of Pharmacy of University of Wisconsin); Harfordia, a new genus of Eriogoneæ from Lower California, by C. C. Parry (Proc. Davenport Acad. Nat. Sci.); The banded-spore Trichias, by Geo. A. Rex (Jour. Mycology); The nectary of Yucca, by William Trelease (Torrey Bulletin); *Micrococcus pasteuri*, by George M. Sternberg (Jour. Royal Microscopical Society); Structure and distribution of resin passages of the white pine, by Etta A. Knowles (Bot. Gaz.); The Cayuga flora, by William R. Dudley (Bulletin of the Cornell University).

ENTOMOLOGY.

The Organ of Smell in Arthropods.[1]—The question whether olfactory impressions as such are received by the Arthropoda,

[1] Abstract by A. S. Packard of a historical and critical study by Dr. K. Kræpelin. Separatdruck aus dem Osterprogramm der Realschule des Johanneums. Hamburg, 1883.

also whether there are specifically formed organs for the perception of this kind of sensation, has always been assumed in the affirmative sense. The naturalists of the previous century have recorded an abundance of observations, which have proved the highly-developed powers of smell at least in insects and Crustacea.[1]

The existence of a definite sense of smell in the greater number of Arthropoda is, as Perris says, "a fact for a long time secured to science, for which there is need neither of arguments nor of proofs." Under these circumstances, it is clear that the question as to the seat of the sense of smell in the Arthropods has for a long time aroused the interest of naturalists. An extensive literature on this subject has grown up in the course of years, names of the first rank appearing in the history of these researches; though perhaps in no field of zoölogical knowledge has such an abundance of acute, difficult work had so small a following as in the examination of the organs of sense, and we are still this day, in spite of the great advance in the last ten years, far from a complete solution of the question.

Historical Sketch of our Knowledge of the Organs of Smell.—In the first half of the last century began the inquiries as to the seat of the sense of smell in the Arthropods. Thus Réaumur, in his Mémoires (I, p. 283; II, 224), expressed in different places the view that in the antennæ was situated a special organ which might be an organ of smell.

In a similar way Lesser,[2] Roesel,[3] Lyonet,[4] Bonnet[5] and others expressed themselves. Before this Sulzer[6] suggested that an "unknown sense" might exist in the antennæ. All these naturalists supposed that there was a common plan in the organization of all animals, and that they must agree with the structure of man. Hence some regarded the antennæ as two completely separate nasal halves, while others compared these appendages to the ears of mammals; others regarded the stigmata as organs of smell, or these were considered the natural passages for the olfactory currents. The oldest advocate of this view appears to have been Reimarus;[7] following him, without knowing of the former's opinion, was Baster (1762). Finally, in the last decennial of the

[1] Scarcely less numerous are the observations and experiments which are recorded in literature as to the perception of sounds by Arthropods. I refer only to the Balaninus, by Bensdorf; the caterpillar, by Bonnet; beetles and gnats, by Kirby; locusts, by Brunelli and Lehrman; the observations of Perris, Lespès, Landois, Rudow and others. Finally, Graber, in his latest work on "The Chordotonal Organs of Sense of Insects," p. 76, remarks: "For the first time exact proof has been afforded that insects in general become influenced by clear sound stimuli."

[2] *Lesser:* Insecten theologie, 1740, 262.
[3] *Roesel:* Insektenbelustigungen, 1746, II, 51.
[4] *Lyonet:* Traite anatomique de la chenille, 1762, 42, 96, 195.
[5] *Bonnet:* Œuvres complètes, 1779–1783, II, 36.
[6] *Sulzer:* Geschichte der Insekten, 1761.
[7] *Reimarus:* Ueber die Triebe der Thiere, 1760, 355.

preceding century, Duméril, in two special treatises as well as in his "Considérations générales," sought to prove this theory as to the seat of the organs of smell in the stigmata, while Schelver thought this view to be at least "not improbable."

Against both of these leading views as to the seat of the sense of smell were expressed, in the last century, different opinions. Thus Comparetti[1] thought that the sense of smell might be localized in very different points of the head, in the antennal club of Lamellicorns, in the sucking tube of Lepidoptera, in special frontal holes of flies and Orthoptera, etc., while Bonsdorf considered the palpi as organs of smell.

Thus were four different views, mixed together, given at the opening of this century; the Hamburg zoölogist, M. C. S. Lehrman, in three different treatises (2, 3, 4), brought together all the hitherto known observations and arguments, treated them critically, and completed them by his own extended studies. Lehrman adopted the opinions of Reimarus, Baster, Duméril and Schelver, that the stigmata presented the most convenient place for the site of the organs of smell; but he is the first who sought to afford a basis for these views by new experiments and also by anatomical data. Regarding the antennæ he was familiar with a number of anatomical details which in part had already been discovered before he wrote, viz, the entrance of a nerve from the brain into each antennæ,[2] the existence of muscles (Comparetti) and "vessels" (Bonsdorf) in them, etc. Cuvier followed throughout the lead of Lehrman, but Latreille[3] returned to the view of the perception of smell by the antennæ, while Treviranus (7, 8), in different journals, considered the mouth of Arthropods as the probable site of the sense of smell, an opinion which, before his time, Huber,[4] in his experiments on bees, had thought to be correct. In 1811 Rosenthal (5) published his discovery of an undoubted organ of smell at the base of the inner antennæ of crabs, and expressed his opinion that in the fly-like animals the sense of smell was probably localized in the folded frontal membrane above the base of the antennæ. This last conclusion seemed so logical to his contemporaries that even Burmeister, in his Handbuch der Entomologie, unhesitatingly accepted it. Less ready assent was given to Ramdohr's discovery, also in 1811, that the organ of smell could be found in the shape of a special vesicle in the head of bees, for the author himself afterwards acknowledged his discovery to be erroneous. A third publication of the same year by Marcel de Serres (26) returned again to the palpi, and asserted—at least in the Orthoptera—their functions to be olfactory, while Blainville,[5] ten years later, again expressed anew the

[1] *Comparetti:* De aure interna comparata, Patavii, 1769.
[2] *Scarpa:* De auditu et olfactu, Ticini, 1789.
[3] *Latreille:* Histoire Naturelle des Crustacés et des Insectes, 1806–1809, II, 50.
[4] *Huber:* Nouvelles Observations sur les Abeilles, 1792, II, 475.
[5] *Blainville:* Principes d'Anatomie Comparée, 1822, I, 339.

old opinion that the antennæ, or at least their terminations, were organs of smell. Up to that date there was an uncertainty as to the seat of the organs both of smell and hearing. Fabricius (57), indeed, had already, in 1783, thought he had found an organ of hearing at the base of the outer antenna; but this opinion was negatived by Rosenthal's discovery of an organ of smell [*sic*] in the inner antennæ of crabs; but as regards the insects, which have but a single pair of antennæ, the question stood at the old point, and it remained a matter of speculation whether this single pair of antennæ had the power of perceiving sounds or smell, or finally, both kinds of sense-impressions. In 1826 appeared J. Müller's valuable work, "Vergleichende Physiologie des Gesichtssinnes," in which this naturalist spoke of an already well-known organ in the thorax [abdomen] of crickets as an organ of hearing. Müller, however, was doubtful, from the fact that the nerve passing to this organ arose, not from the brain, but from the third thoracic ganglion; but, notwithstanding, he remarks: "Perhaps we have not found the organ of hearing in insects because we sought for it in the head." This discovery was afterwards considerably broadened and extended by Siebold's work,[1] for the views of these naturalists on the seat of both organs had a definite influence, especially in Germany. At present, indeed, Müller's hypothesis stood in complete contradiction, so that during the following decennial was presented anew the picture of opposing observations and opinions as to the nature of the organs of smell. While Robineau-Desvoidy, at the end of the twentieth year, and also later, in different writings (27, 34), strove energetically for the olfactory nature of the antennæ, Strauss-Dürkheim[2] held fast to the view that the tracheæ possessed the function under discussion. At the same period Kirby and Spence, in their valuable Introduction to Entomology, maintained that "two white cushions on the under side of the upper lip" in the mouth of biting insects formed a nose or "rhinarium" peculiar to insects. This opinion was afterwards adopted by Lacordaire (Introduction à Entomologie, 11), and also by Oken in his Lehrbuch der Naturphilosophie, while Burmeister, rejecting all the views previously held, believed that insects might perhaps smell "with the inner upper surface of the skin." Müller's locust's ear he regarded as a vocal organ.

Besides these occasional expressions of opinion, the French literature of the thirtieth and fortieth years of this century recorded a long series of special works, with weighty experimental and physiological contents, on this subject. Thus Levebre, in 1838 (28), described the experiments which he made on bees, and

[1] *v. Siebold:* Ueber die Stimm- und Gehörorgane der Orthopteren, Archiv für Naturgeschichte, Jahrgang 10, 1, 52–87, 1844.

[2] *Strauss-Dürkheim:* Considérations générales sur l'Anatomie Comparée des animaux articulés, etc. Paris, 1828, 422.

which seemed to assign the seat of the sense of smell to the antennæ. Dugès[1] reported similar researches on the Scolopendræ, and Pierret (32) thought that the great development of the antennæ in the male Bombycidæ might be similarly interpreted. Driesch (29) sought to give currency to the views of Bonsdorf, Lamarck and Marcel de Serres, that the sense of smell was localized in the palpi, though Duponchel (30, 31) went back to the old assertion of æroskepsis of Lehrman, *i. e.*, of the air-test through the antennæ, and Goureau (33) again referred the seat of the sense of smell to the mouth. In England, Newport (45) at this period put forth a work in which he considered the antennæ as organs of touch and hearing, and the palpi as organs of smell—a view which, as regards the antennæ, was opposed by Newman (43).

Thus the contention as to the use of the antennæ and the seat of the organs of smell and hearing fluctuated from one side to the other, and when in 1844 Küster (9), by reason of his experiments on numerous insects, again claimed that "the antennæ are the smelling organs of insects," he argued on a scientific basis; yet v. Siebold and Stannius (1848), in their valuable Lehrbuch der vergleichenden Anatomie (p. 581), remarked that "organs of smell have not yet with certainty been discovered in these animals."

These naturalists were more happy with the crabs, whose organs of smell, with Rosenthal, they localized in the vesicle at the base of the inner antennæ, though Farre (46) had regarded these cavities as possessing the function of hearing.

The following decennial was of marked importance in the judgment of many disputed questions. Almost contemporaneously with Siebold and Stannius' Lehrbuch appeared an opportune treatise by Erichson (10), in which this naturalist first brought forward certain anatomical data as to the structure of the antennæ of insects. In a great number of insects Erichson described on the upper surface of the antennæ peculiar minute pits, "pori," which, according to him, were covered by a thin membrane, and to which he ascribed the perception of smell. A still more thorough work on this subject was published in the following year by Burmeister (11), who recognized in the pits of Lamellicorns many small tubercles and hairs; and about the same time Slater (12), as also Pierret and Erichson before him had done, out of the differences of the antennal development in the males and females in flesh and plant-eating insects, brought together the proof of the olfactory function of the antennæ. But the most valuable work of this period is that of Perris (36), who, after a review of previous opinions, by exact observations and experiments, a model of their kind, sought to discover the seat of the sense of smell. He comes to the conclusion that the antennæ,

[1] *Dugès:* Traité de Physiologie Comparée, 1838, I, 160.

and perhaps also the palpi, may claim this sense, and finds full confirmation of Dufour's (37) views, and adopts as new the physiological possibility expressed by Hill[1] and Bonnet,[2] that the antennæ might be the seat of both senses—those of smell and hearing.

As for the Crustacea, it was through Huxley,[3] and still more through Leuckart,[4] that the evidence was afforded that Rosenthal's—also adopted as such by Blainville—olfactory organ at the base of the inner antennæ should be regarded as an apparatus of hearing. Huxley therefore thought, following Farre and Robineau-Desvoidy, that the seat of the sense of smell must lie in the organ discovered by Fabricius in the outer antenna, while Leydig,[5] almost at the same time, considered certain pale, minute hairs on the terminal joint of the inner antennæ as specific sense-organs.

The beautiful works of Erichson, Burmeister and Perris could not remain long unnoticed. In 1857 Hicks (47, 48, 49) published complete researches on the peculiar nerve-endings which he had found in the antennæ, also in the halteres of flies and the wings of all the other groups of insects,[6] and which he judged to be for the perception of smell. But Erichson's and Burmeister's "pori" were by Lespès, in 1858 (38), explained to be so many auditory vesicles with otoliths. This view was refuted by Claparède (39) and Claus (13), without their deciding on any definite sense.—*To be continued.*

ZOOLOGY.[7]

REPRODUCTION OF THE VISCERA IN THE FEATHER-STARS.—It has been known for nearly four hundred years that Comatula, a living crinoid, is capable of casting its visceral mass at will, or upon slight irritation, while in 1884 it was shown by Professor A. Milnes Marshall that one species had the power to reproduce the parts thus lost. Mr. Arthur Dendy has recently studied the subject and suggests[8] that since these animals have no selective power over their food supply, this ability to cast out the stomach may be a provision for getting rid of any noxious matter or disagreeable parasite introduced by the ciliary currents. The line of separation takes place between two layers of connective tissue, one of which lines the cup in which the viscera rest while the

[1] *Hill:* Hamburger Magazin, XVII, 391.

[2] *Bonnet:* Contemplation de la Nature, III C, 18.

[3] *Huxley:* On the Auditory Organs in the Crustacea, Ann. and Mag. Nat. Hist. II Ser. Vol. VII, 1851.

[4] *Leuckart:* Ueber die Gehörwerkzeuge der Krebse, Archiv für Naturgeschichte, 1853, I, 255, 304–306, 373–374.

[5] *Leydig:* Ueber Artemia salina und Branchipus stagnalis, Zeits. f. w. Zoologie, III, 1851, 287.

[6] Graber's sketch of our earlier knowledge of the "peg-bearing" organs (the chordotonal sense-organs of insects) pp. 509, 558, 586, are therefore to be corrected n the foregoing sense.

[7] Invertebrata edited by J. S. KINGSLEY, Sc.D., Malden, Mass.

[8] Studies Biol. Laboratories Owens College, Vol. I, pp. 299–312, 1886.

other forms an envelope for the viscera themselves. The viscera thrown off decay while the animal replaces them with new. It would appear that the epithelial lining of the stomach was derived from an invagination of the epidermis of the roof of the visceral basin, while the limiting connective tissue arises from that left behind in the cup. The ambulacral system is also regenerated from the epidermis, and with it the ambulacral nerves. This case is far more interesting than that afforded by star-fishes and brittle-stars, in that while they can restore lost arms or even a part of the visceral mass, Comatula can reproduce the whole of the digestive system.

The Leeches of Japan.—Dr. Whitman, in the Proceedings of the American Academy of Arts and Sciences (Vol. xx, 1884) adverted to the poor quality of the work done on the leeches, but his present paper on the leeches of Japan (*Quart. Jour. Micros. Sci.*, xxvi, 1886) is certainly not open to criticism as to carefulness and accuracy. It deals with the species of the family Hirudinidæ, and is illustrated by exquisitely executed colored plates after drawings by a Japanese artist. Besides this it contains some morphological notes and observations on habits which are interesting. Dr. Whitman shows that on each segment of a leech there are certain sense organs which are serially homologous with the eyes, and which besides are somewhat similar to the latter in structure, each possessing the same peculiar large clear cells. What the function of these segmental sense organs is, remains unsettled, but the experiments detailed go to show that they have the power of recognizing the differences between light and darkness, and that they are not concerned with smell or taste. The similarity of these to the lateral line organs of fishes in their early stages is pointed out and the homology of the two suggested.

Myriapod Anatomy.—Mr. C. G. Bourne publishes in the Journal of the Linnean Society a paper on the anatomy of Sphærotherium, a genus of Myriapods from the Cape of Good Hope, allied to the more familiar Glomeris. Among the more interesting or important points brought out may be mentioned the following: The existence of stridulating organs; the presence of peculiar sense organs on the tips of the antennæ; and the peculiar structure of the tracheal system, which deserves a moment's attention. The tracheæ have the same distribution as the legs, that is, there is a pair in each of the first three pedigerous segments of the body, and in the remainder there are two pairs in each segment. Each stigma opens into a large sac, and from this the spiral-walled tracheal tubes take their origin. The author insists that both here and in Peripatus the opening to the tracheal sac should be regarded as the spiracle and not the opening from the sac into the trachea. The paper also has some notes on a possible organ of hearing.

LEPTODORA IN AMERICA.—The American Society of Microscopists, at its meeting in August, devoted a day to dredging and skimming in Chautauqua lake. The most noteworthy find was a specimen of the beautiful little cladoceran crustacean, *Leptodora hyalina.* This species was previously known in this country only from a single somewhat mutilated specimen recorded by S. I. Smith from Lake Superior. Mr. Charles S. Fellows, however, has taken a few specimens from a lake near Chicago. *Leptodora hyalina* is the largest of its group, reaching a length of an inch.

NERVOUS PHYSIOLOGY OF THE LOBSTER.—Mr. C. F. Marshall has been studying the nervous system of the lobster, and comes to the following conclusions: That the thoracic nerves did not have separate motor and sensory roots, while in the abdominal region the anterior nerve arising from each ganglion was both motor and sensory, and the posterior was sensory alone; the second thoracic ganglion is a special reflex center for the great claw, and that reflex actions were more marked when this ganglion was separated from the brain; and lastly that there is no such marked decussation of nervous fibers in the central cord as exists in vertebrates. This last point will repay farther study, for nervous impulses travel across the ganglia from one side to the other.

MORTALITY OF FISH AT LAKE MILLE LAC, MINNESOTA.—The above lake, lying in the east central part of the State, is about twenty-two miles long and eighteen miles wide. It is, for the most part, very shallow, and consequently during June, July and August its waters are very warm.

Every summer for several years past, after a strong wind has been blowing on shore for a day, the beach is strewn a distance of many miles with thousands of fine fish. Some of these are found just expiring, others but just dead, and others far advanced in decomposition, the latter appearing to have been floating in the water for a long period.

The evident cause of the death of these is the presence of an external parasite, one of the Siphonostomata, which we found swarming on head, operculum and belly. These parasites are translucent, disgusting-looking creatures, about the size and shape of a wood-tick, though many are larger, the abdomen furnished with an umbrella-like disk, which apparently assists them in clinging to their slippery hosts.

The back of the fish, near the head, is the spot most frequently affected, though many specimens were found with large eaten patches on the sides and belly, and the part so attacked had become covered with a brown slime. This in specimens hardly dead, would indicate they had lived some time in a diseased condition.

During five weeks observations in June and July, I found that

among these fish the wall-eyed pike (*Stizostedium vitreum*) was the most abundant, ranging in length from ten inches to two and one-half feet.

There were, too, hundreds of perch (*Perca americana*), rock bass (*Ambloplites rupestris*), black bass, (*Micropterus salmoides*), bull heads (Amiurus) crappies (*Pomoxys annularis*), calico bass (*P. sparvides*) and many other specimens of a variety of white fish (*Coregonus artedi*). Also the "ling" (*Lota maculosa*), an occasional dog-fish (*Amia calva*), many pike (*Esox lucius*), and large suckers.

The warm water of the large lake probably helps to incapacitate the fish, for in the smaller lakes in the vicinity, which are fed by springs, the fish are comparatively free from such enemies.

I might say here I found no sure indication of the muskellunge (*Esox nobilior*) inhabiting Lake Mille Lac. The specimens of so-called "muskellunge" shown me by the farmers were giant specimens of *E. lucius.*—*F. L. Washburn.*

Longevity of Turtles.—The following history is so well authenticated that I believe it should be published, and thus permanently put on record. I am personally acquainted with the principal parties.

In 1824 Mr. J. W. Warrington, one of the pioneer pedagogues of this vicinity, found a small *Testudo carolina* Linn., on the plastron of which he engraved, with his pen-knife, "J. W., 1824" and set it free near Albion, Ill. Some time during 1865 Mr. W. Hodson found it in the same vicinity where it had been set free forty-one years before. He engraved the letter "W" on the carapace and again set it free. Nothing more was seen of it until August, 1885, when it was found by Mr. Herbert Hodson (brother to W.) about one-half a mile from the spot where it had been set free twenty years before. He put it into his cellar where it remained until this (1886) summer, when it by accident was poisoned by "Rough on Rats," and died from the effect. The engravings are all apparently as clear as when first made. The tortoise was below the medium size, and appears to have grown very little since the first engraving was done, sixty-two years since. The shell is darker and smoother than usual. On the back is a scar which appears to be the remains of an extensive fracture. Mr. H. Hodson has three other tortoises that were engraved twenty-one, seventeen and sixteen years since respectively. In illustration of the slow growth of these reptiles, I will mention that more than a year since he broke open an egg in which was found a young tortoise; this he has since kept in confinement. It has made no perceptible progress in size during this time. Several years since I kept a young *Pseudemys elegans* Wied. in confinement for more than two years. It made no perceptible increase in size, yet it partook quite freely of food.—*J. Schneck, Mt. Carmel, Ill., Sept. 22, 1886.*

GAPES IN FOWLS.—The fact that the disease known as gapes in poultry is produced by a parasitic worm (*Syngamus trachealis*) which infests the trachea of the birds was settled long ago, and for most of our recent knowledge of the worm and the disease we are indebted to the prize essay of Pierre Megnin. According to this author the mature worms and their eggs are coughed out of the throat of the infested fowl and the disease is spread by its associates picking them up along with their food or by drinking water in which the eggs may have hatched into larvæ. No suggestion is allowed of any intermediate host. Mr. H. D. Walker, in an apparently carefully prepared paper on this subject (Bulletin Buffalo Society Nat. Sciences, v, pp. 49–71, 1886) details many experiments which he has tried, and several of them point very strongly to the conclusion that the earth-worm may, in many cases, play a part in the distribution of the pest. The embryos have been found living in the earth-worm at all seasons of the year, and earth-worms from infested localities, when fed to chickens, almost invariably produce the disease. Dr. Walker has also produced the disease in robins, and claims to have found the embryo of the lung-worm of calves (*Strongylus micrurus*) in the earth-worm.

PROTRACTED FLIGHT OF A GOLDEN PLOVER.—An instance of remarkably long-protracted flight of a golden plover (*Charadrius virginicus*) came under my personal observation on May 5th, 1885, and is again called to mind by the article on "Gravitation and the Soaring Birds" in the June number of the NATURALIST.

The incident occurred on board the steamship *Oceanic*, bound from San Francisco to Yokohama, on the eighth day out of port and in latitude 37° N., longitude 156° W. For three days a stiff gale had blown from the N. N. W., and abated with fair weather on the morning of the day mentioned. At about 6 P. M. a golden plover was observed perched on the taffrail in a thoroughly exhausted condition, with open bill and drooping wings, having evidently just alighted.

So nearly spent was the bird that he was captured without difficulty and retained as prisoner for several days; but though he ate food supplied him, so great was the strain to which he had been subjected, that on accidentally escaping he fell into the ocean on attempting to fly, and was drowned. At the time his presence was first discovered on board, the ship was 1140 miles from the nearest land, one of the Hawaiian island group, lying to the south. Northerly the nearest land was one of the Aleutian islands, distant 1320 miles, while the nearest continental land was the coast of Alaska, no less than 1500 miles away. In all three of these regions the golden plover lives and breeds. He is also a transient visitor on the Californian coast which we left behind us eight days previously. The question now arises: From which of these localities did our feathered waif hail?

The first casual supposition that he must have been a stow-a-way brought from port, must be acknowledged, on further consideration, as unsupported by fact.

The date of sailing, April 28th, was too late to support the probability of such an origin, all golden plovers having probably migrated from semi-tropical California to their northern breeding grounds at a much earlier date. Then the existence of such a stow-a-way on board, undiscoverd for eight days, was at best improbable; for had starvation not forced an earlier discovery, the numerous cats and dogs on board would have inevitably flushed the bird. The condition of our visitor when discovered, and his ultimate fate, also preclude the possibility of his having traversed by steam power the distance from shore to mid-Pacific.

To have reached us from the southward he must have flown over 1100 miles in the very teeth of a protracted and violent gale, a feat we may well set aside as impossible. One source of origin for our winged visitor alone remains: At the time of his discovery he had certainly just finished a long and utterly exhausting flight.

Far northward on the Alaskan coast he must have been caught by the gale through which we passed, and borne out to sea beyond hope of return, and then swept on and on by the winds till the storm forsook him, perhaps 1500 miles from the spot from whence it tore him. Then after a day's battling against the elements, instinct or chance, or Providence directed his flight toward the only possible goal of refuge, and his wonderful voyage came to an end in the mid-Pacific more than 1300 miles from the nearest possible starting point, after a pauseless flight over this great expanse of waters.

Phenomenal as the occurrence seems, I believe I have expressed the only logical conclusion warrantable by the facts obtainable. Moreover, the latter are to a certain degree supported by another incident observed by me less than three weeks later.

On the evening of May 23d, while a passenger on the Japanese steamer *Higo Maru*, bound from Yokohama to Hakodate, and about twenty miles from the coast of Japan, the snow-covered coast hills of which were plainly visible, a golden plover lighted in a perfectly fresh condition on the davits. On being approached by myself and the captain of the steamer, the bird flew away a few yards and realighted. After a few moments halt on his second perch he again took wing and disappeared in the distance, but *did not fly toward land.* This bird had certainly flown twenty miles without rest, yet bore not the slightest evidence of fatigue.

That the exhausted refugee on the *Oceanic must* have flown a great distance the comparative condition of the two individuals proves. How great that distance was must remain a conjecture, but that it stretched away to the nearest windward land is, in my opinion, the only rational conclusion.—*H. E. Stockbridge, Sapporo, Japan, August 9, 1886.*

NOTES ON THE ZOOLOGICAL GARDENS AT ANTWERP AND LONDON.—The Zoölogical Gardens at Antwerp contain at present one great mammalian curiosity, the Anoa of Celebes, a creature something between an ox and an antelope. The gardens are tolerably rich in antelopes generally, also in carnivores. The series of cassowaries is more complete than that of the London Zoölogical Gardens, and there is a very full list of raptores.

The collection at Antwerp is really a fine one for the size of the city, only one-fourth that of Philadelphia, which with difficulty supports its "Zoo."

Both these gardens and those of London have an example of the Lycaon, or South African hunting-dog. The great attraction of the London Zoo is a young chimpanzee, var. tschego *(Simia calva)*, the first specimen of the species that has been taken alive. When caught she was two years old, and is now more than five. Lively, sly and full of fun, this young creature is quite a contrast to the usual listless ape of the menageries, and the great difference leads one to believe that idiosyncracy or ill-health, or a combination of the two, are the causes of the apathy so generally exhibited by man's nearest relatives when in confinement. This animal is as full of tricks as any of the smaller monkeys. She will play with visitors very gently until she has gained their confidence, and will then suddenly seize a hat, bonnet or other removable article. She is a particularly good ratter, but expects her keeper to assist her, calling ugh, ugh, to induce him to stop the rat's escape in one direction, so that she can catch it in another. This unsophisticated female child came from the Gaboon.

Cockroaches are exceedingly plentiful in the chimpanzee house of the London Zoo—they are not the vulgar native species, the black beetle of London homes, but emanate from the West Indies, whence they accompanied some more noble animal. In the warm atmosphere they live and multiply, though a severe frost kills many, and those who escape from their quarters fortunately perish. The keeper often catches some of these beauties for entomological enthusiasts.

In the same house with the chimpanzee are cages containing petaurists, rat-kangaroos, dasyures and other small marsupials, most of them, as is their habit, lying coiled up in a corner of their dwellings, and appearing as mere lumps of fur. In the bear house are two fine examples of the rare Tasmanian wolf (Thylacinus).

As in the gardens at Philadelphia, the heaviest animal is a rhinoceros. This *R. unicornis* weighs about three tons. The largest of the young elephants is but little less, and will grow seven inches in height yet. Jumbo's position is occupied by two young African elephants, whose united bulk would be far inferior to that of their gigantic predecessor. The London Zoo is

rather awkwardly situated and inconveniently shaped. It is almost a mile from the nearest railway station (Portland road, on the Metropolitan or Underground railway), and is divided into three unequal sections by a public road and a canal, the former crossed by means of a tunnel, the latter by a bridge. The reptile house, the bears, otters, seals, canines, pheasant and other bird paddocks, birds of prey, etc., etc., are in the largest division; on the other side of the road are the elephants, rhinoceros, giraffes and other large herbivores, many deer and antelopes, the marsupials, chimpanzee, edentates and parrots, while the insect house is beyond the Regent canal.—*W. N. Lockington.*

Human Cerebral Fissures, their Relations and Names and the methods of studying them.[1]—In 1873 Professor Wilder read before the Amer. Association for the Adv. of Science a paper on the fissures of the Carnivora. Since that time he has prepared for the museum of Cornell University many human brains, fœtal as well as adult, and of several races; has examined nearly all the literature of the subject and published several papers on special points, the latest being "On the paroccipital, a newly recognized fissural integer" (Jour. of Nerv. and Mental Disease, June, 1886), and communications before the recent meeting of the Am. Neurol. Assoc. While far from satisfied on certain matters, since each fissure should be monographed, the conclusions now presented are, he believes, worthy of consideration. The study of the human fissures should be preceded by the study of the general characteristics of fissures upon some animal easily obtained at all stages of growth, and in which their arrangement is more simple. At present no help is gained from the attempt to refer the human fissures to a series of regular arches. The memorizing of their positions and names may be facilitated by regarding the cerebral surfaces simply as unexplored regions, and by learning certain fissures before others. The "*landmarks*" are the *mesal margin of the hemicerebrum*, the *callosum* and the *Sylvian fissure*. Accepting the usual division of each hemicerebrum into lobes, *occipital, temporal, parietal and frontal*, the last may be advantageously subdivided into *prefrontal and postfrontal* by a line continued from the presylvian fissure. The first fissures to be studied are the ten *interlobar: Sylvian, presylvian, central, circuminsular, callosal, occipital, hippocampal, exoccipital, preoccipital* and *preoccipital fovea*, the last three perhaps inconstant. Next the seven *constant, intergyral fissures with structural correlatives: basisylvian, olfactory, amygdaline, calcarine, collateral, postoccipital fovea*, and *lambdoidal* (not Owen's but one lately shown by Professor Wilder to be collocated in the fœtus with the lambdoidal suture). Third, the fifteen *constant, intergyral fissures, without struc-*

[1] Abstract of paper read before the A. A. A. S. at Buffalo, Aug., 1886, by Burt G. Wilder, M.D.

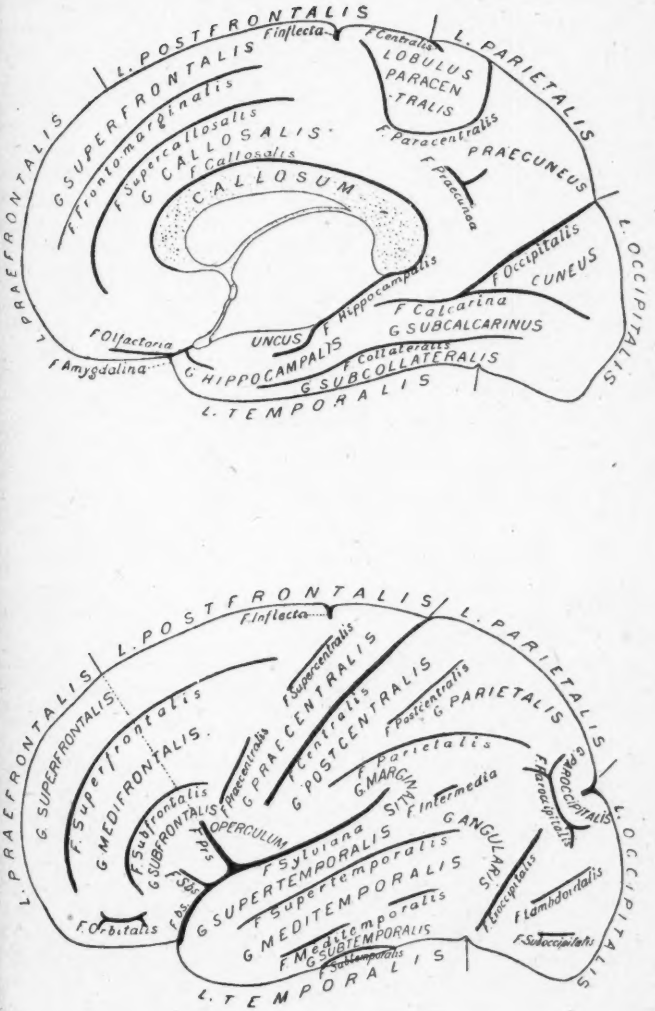
tural correlatives: Paracentral, paroccipital, supertemporal, meditemporal, subtemporal, subfrontal, superfrontal, insular, supercallosal, orbital, precentral, supercentral (dorsal part of precentral), *postcentral, parietal* and *precuneal.* Lastly the thirteen *intragyral, inconstant fissures: Adoccipital, inflected, fronto-marginal, postcalcarine, subоccipital, preparoccipital, postparoccipital, intraparacentral, medifrontal, intermedia, subsylvian, episylvian* and *hyposylvian.* Total, including the *sagittal* (*interhemicerebral*) forty-six, a larger number than before enumerated. The names are *mononyms*, selected or formed from names in common use or already proposed by some original investigator. Most of them imply either the relation of fissures to structural correlatives or their position relative to some main fissure. The same is the case with most of the gyral names, but a few have been correlated with the bordering fissures; *lingual* and *fusiform*, for example, are replaced by *subcalcarine* and *subcollateral.* The paper was illustrated by diagrams of the mesal and lateral aspects of the hemicerebrum, and by lists of the fissures grouped as above. Some of the fissures were discussed in detail, and the paper concluded with an expression of the belief that the common idea of the usefulness of the brains of monkeys as foundations for the study of human brain is erroneous, and that, contrary to the view and practice of Meynert, it is much better to examine fœtal brains at various stages of growth.

EXPLANATION OF PLATE XXIX.

The figures are diagrammatic, but based upon a very simple, adult, mulatto brain, No. 322 in the museum of Cornell University, and they probably represent an extreme degree of fissural independence.

The gyral names are in capitals. The fissural names are in italics and commonly placed just below the fissure lines. All the names on the figures are Latin, but the English paronyms are used in the text. The abbreviations *F. prs.*, *F. sbs.* and *F. bs.* stand respectively for the presylvian, subsylvian and basisylvian fissures. The *exoccipital* is Wernicke's fissure, or the occipitalis anterior of Schwalbe.

ZOOLOGICAL NEWS.—*Crustacea.*—Of the twenty-one bottom-inhabiting abyssal species of Decapoda enumerated by Mr. S. I. Smith, eight have normal black eyes, two have abnormally small eyes, three have eyes with purplish or very light-colored pigment and eight have eyes of doubtful function. Of the five species taken below 2000 fathoms one has well-developed black eyes, two have abnormally small black eyes, and one eyes of doubtful function. In spite of the objections of the physicists, our authority thinks it probable that some kind of luminous vibrations penetrate to depths exceeding even 2000 fathoms, at least in the pure waters of mid-ocean, though there is doubtless a tendency towards a radical modification of the eyes in deep water.——The large size and small number of the eggs is a marked characteristic of many deep-sea Decapoda, and in one case (*Bythocaris leucopis*) this has been proved by Professor G. O. Sars to be accom-



Human cerebral fissures.

panied by an abbreviated metamorphosis within the egg.——Sars, some years ago, claimed that the accessory eyes of Euphausia were luminous organs. This statement has just been confirmed by Mayer and Ghiesbrecht. Isolated and crushed with the cover-glass under the compound microscope, the thoracic eyes shone brightly, the light apparently proceeding from the bundles of rods. Another specimen was treated with aqua ammonia, when the so-called eyes appeared as so many points of light, the rest of the body remaining dark.

Brachiopods.—L. Joubin, in a somewhat detailed account of the anatomy of Crania and Discina (Arch. Zool. Expérimentale, II, IV, 1886) comes to the conclusion that the Brachiopods, though approaching more closely to the Polyzoa than to any other group in the animal kingdom, are to be regarded as "a class absolutely distinct and independent."

Reptiles.—At a meeting of the Royal Society of Tasmania it was stated that a black snake (*Hoplocephalus curtus*) four feet three inches in length, had been found to contain 109 young. Mr. Morton stated that the greatest number he had previously known to be taken from a similar snake was thirty-two, though he had heard of seventy from an allied species.

Birds.—*Nature* has, in a recent issue, given several examples of male birds caring for the eggs and young. One of these is that of a turkey cock which incubated six fowl's eggs and hatched three chickens, which he treated with all the care of a hen. He appears to have been moved to this act by the failure of his mate to raise offspring. The male ostrich, in a semi-domestic state, undertakes a large share, sometimes the whole, of the nidification. The male alone of the pair of Apteryx at the Zoölogical Gardens of London, sat upon the eggs, but his fifteen weeks assiduity produced no result. Another case is that of a bantam cock which brought up a brood of chickens the mother of which had died when they were two days old. The emu, according to Mr. A. Bennett's observations of birds bred by his father, begins to lay about the end of October, laying twenty or more eggs at intervals of two days. The male bird begins to sit before all the eggs are laid, the eggs laid subsequently being deposited by the hen beside her mate, who puts out his foot and draws them under him. When the eggs begin to hatch it is necessary to isolate the hen, who fights furiously with her mate, and to all appearance would kill the chicks if she could get at them. The whole of the tending of the young is performed by the male bird.

Mammals.—G. E. Dobson notes the presence, in the peculiar *Myosorex varius* Smuts., of South Africa, of a seventh very small mandibular tooth lying between the second and third teeth, and from the direction of the cusp apparently a lower canine. From this it would follow that the other shrews have no lower canines.

——One of the most startling of Dr. Paul Albrecht's homologies or rather homo-dynamies is that which he seeks to trace between the claspers of a ray and the penis or clitoris of a mammal, bird, etc. It is, he says, the two hemipenes or claspers united, and cases of epi and hypo-spadias are atavisms. The skeleton, muscles and nerves of this organ, according to Albrecht, belong to the extremities. —— Dr. C. Hartlaub has (Zoologischen Jahrbüchern, Band 1) given the results of an investigation of the specimens of manatees in various European museums. He fully establishes the specific difference between the African *M. senegalensis* and the American *M. latirostris*, and describes for the first time the skull of the South American *M. inunguis*, a species absolutely ignored by most naturalists, but the distinctness of which he proves. The African manatee inhabits the west coast of Africa from the Senegal to the Quanza, and penetrates far into the interior up the larger rivers. The "water sheep" spoken of by Schweinfurth in the Welle, and the supposed manatee found in Lake Tchad and the Shari by Barth and others, may prove to be another species. In America the exact boundaries between *M. inunguis* and *M. latirostris* cannot be certainly stated, on account of the confusion that has hitherto existed between these forms. But it is certain that the manatee occurs from 25° N. lat. to 19° S. lat., and that that of the Antilles, Gulf of Mexico and Surinam is *M. latirostris*. *M. inunguis* is only certainly known from the Amazon and its tributaries.

PSYCHOLOGY.

THE DREAMS OF THE BLIND.—A paper read before the biological section of the American Association for the Advancement of Science was on "The Dreams of the Blind," by Dr. Joseph Jastrow. The object of the paper was to determine the extreme age at which a child may become blind and yet lose all memory of the visible world, so that it no longer sees in its dreams.

Almost all dreams of normal persons are sight-dreams, and a dream is often spoken of as a vision. The blind are deprived of this most important sense; but if they have not been born blind they may remember enough of what they have seen to enable them to imagine how things look, and when the imagination has free play in sleep to picture themselves as in full possession of all their senses. Physiologists would explain this by saying that during the years in which they saw, a certain part of the brain has become educated to receive and interpret all these messages which the eye sends, and that when this part of the brain acts spontaneously in sleep the person dreams of seeing. Such a portion of the brain would be called the sight center.

If now we find out the latest age at which blindness may set in and yet the person keep on dreaming of seeing, we will find out the time it takes for this sight center to develop. For this pur-

pose about 200 blind persons of both sexes were questioned at the institutions for the blind in Philadelphia and Baltimore, and it was found that those who became blind before their fifth year never dreamed of seeing; of those whose sight was lost between the fifth and the seventh year some did and some did not see in their dreams; while all whose eyesight was destroyed after the seventh year had quite as vivid dream-visions as seeing people. The fifth to the seventh year is thus shown to be the critical period. This period corresponds with the age which authorities assign as the limit at which a child becoming deaf will also become dumb; and also with the age of one's earliest continuous memory of oneself.

It is interesting to note that blind persons dream quite as frequently as normal people, and that with those who do not see in their dreams, hearing plays the principal part. When dreaming of home, for instance, they will hear their father's voice or their sister singing, and perhaps will feel the familiar objects in the room and thus know they are at home. We, in such a case, would see it all.

ANTHROPOLOGY.[1]

ANTHROPOMETRY, says Francis Galton, is designed to define the individual or the race, and to show in what way and to what extent, he or it differs from the others. Measurements teach the individual to know his own powers at a given time. The second important object is to keep watch over the development during the period of growth, and to give timely warning if it proceeds not normally.

The measurement of the head is designed to show how much and up to what age the brain continues to grow in bulk, especially with a view to comparing the educated with the uneducated classes.

The maximum length of the head is taken from the glabella, or the smooth spot above it, by means of calipers with blunt teeth like a comb.

The maximum width is taken with the same instrument, between the points farthest apart on the sides of the head.

The maximum height is the length of a line perpendicular to a plane passing through the ear holes and along the lower and outer edges of the orbits.

These instruments are constructed by the Scientific Instrument Company, of Cambridge, England.

Instead of the tints of Broca and Chevreuil, Dr. Galton uses disks of glass for the color of the eyes, and spun glass of various tints for the hair. The object is to secure standards that will not fade.

A new instrument for measuring the squeeze of the hand has

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

been devised by Mr. H. Darwin, which avoids the disadvantage experienced in the old dynamometer when the handles are brought close together.

In criticising the apparatus used for testing acuteness of sight, Dr. Brudenell Carter drew attention to the difference between testing the acuteness of vision and the acuteness of perception of slight differences of the intensity of light. He contended that nothing was an accurate test of acuteness of vision unless it called upon the person tested to see the separateness of two or more objects, such as spots, which were separated from each other by intervals equal to their own diameters.

Mr. Galton draws attention to the apparatus devised by Mr. Cattell, an American, now assistant in Professor Wundt's Laboratory, at Leipzig, for testing the color and the sound sense.—*J. Anthrop, Inst., xvi, 2–11.*

The Cephalic Index.—The two essentials to a correct system of obtaining the rates of the length to the width of the skull are (1) that the measures should always be taken upon exactly the same points, and (2) that the fractional limits of the terms dolichocephalic, mesaticephalic, and brachycephalic should be the same for all investigators. Now, great efforts have been made in France and Germany to achieve these results, and Dr. Garson, in England, following the instructions of the Anthropological Institute, has conducted an extensive correspondence to the same end, and an international agreement has been reached, as follows:

1. The metric system is to be used exclusively in all linear measurements.

2. The cephalic index to be calculated from the maximum length and maximum breadth of the cranium; the maximum length being the distance between the most prominent point of the glabella of the os frontis in front, and the most prominent point of the os occipitis behind, in the mesial plane. The maximum breadth is the width across the broadest part of the cranium wherever that may be, except on the mastoid processes and the supramastoid ridges, measured vertically to the mesian plane, the points of measurement lying opposite to one another in the same horizontal plane.

3. The cephalic index to be divided into groups of equal dimensions, each containing five units and arranged systematically on each side of a median or central division corresponding to the mean of the human species.

4. The central group to be denominated the mesaticephalic division and to include indices from 75 to 79.9.

5. The quinary division below and above the central group to be termed dolichocephalic and brachycephalic respectively, the former having limits of 70 to 74.9, the latter of 80 to 84.9.

6. The second quinary divisions—those on either side of the last two—to be termed hyper-dolichocephalic and hyper-brachycephalic, with the respective limits of 65 to 69.9, and 85 to 89.9.

7. The third quinary divisions to be called ultra-dolichocephalic and ultra-brachycephalic respectively, with limits of 60 to 64.9, and 90 to 94.9.

8. The quinary division of the cephalic index to be extended in each direction as far as there are indices to classify. These divisions may be designated by their limits, or by the number of quinary divisions they are removed from the mesaticephalic division, that being considered 0.

Collected in a tabular form the division and nomenclature agreed upon is as follows:

3. Ultra-dolichocephalic	60–65	excl.
2. Hyper-dolichocephalic	65–70	"
1. Dolichocephalic	70–75	"
0. Mesaticephalic	75–80	"
1. Brachycephalic	80–85	"
2. Hyper-brachycephalic	85–90	"
3. Ultra-brachycephalic	90–95	"

—*J. Anthrop. Inst., xvi, 17–20.*

THE PEABODY MUSEUM.—The eighteenth and nineteenth annual reports, forming numbers 5 and 6 of volume III, have just appeared. The greater portion of these reports refer to explorations in the Little Miami valley, Ohio. With the coöperation of Dr. C. L. Metz, Professor Putnam has conducted a series of diggings which are quite as remarkable for their thoroughness as for their successful results. The plan has been to lay a mound, earthwork or cemetery on the dissecting table, to remove carefully the outer coverings, to separate the interior portions, and to arrive at genetic relationships on broad comparative grounds.

An important discovery were burial chambers of logs in the Edwin Harness mound. They were made by placing logs from five to six inches in diameter on the clay which forms the lowest layer of the mound in such a way as to make enclosures six to seven feet in length, and from two to three in width, and about a foot in height. In these the bodies were placed, evidently wrapped in garments, as indicated by the charred cloth and mats found in several of the chambers. With the bodies were buried various objects, such as copper plates, earrings, shell beads, and in one instance, long knives chipped from flint. In two instances the skeletons were found extended at full length within the chambers, the outlines of which could be traced by the imprint of logs in the clay. In the other chambers the bodies had been burnt on the spot. These chambers had been covered by little mounds of gravel and clay, and in those where the burning had taken place the coverings of earth were placed in position before the bodies were consumed. After all the little mounds had been

made, earth was brought from various surroundings and heaped over all.

Dr. William F. Whitney publishes in the report a paper on anomalies, injuries and diseases of the bones of the native races of North America.

The anomalies are accidental and designed deformations of the skull together with their structural consequences.

The injuries comprise the results of dislocation or fracture. A just distinction is drawn between injuries made long anterior to death and those made shortly before and after death.

Diseases are grouped under exostoses, periostitis, caries and cicatrices.

Dr. Metz and Professor Putnam present an elaborate monograph upon the Marriott mound, No. 1, and its contents.

West Indian Stone Implements.—Mr. E. F. Im Thurm describes in the June number of Timehri (Demerara) the archæological collections of Sir Thomas Graham Briggs, from the islands of St. Vincents, St. Kitts, Nevis, St. Lucia and Antigua. The implements are celts, mullers, mortars, and were all found on the surface. The author devotes considerable space to the discussion of the function of the celts, which present some new forms in addition to the ordinary almond-shape so prevalent in the Carib area.

Indian Children's Games.—Mr. Im Thurm in Timehri, speaks of the sports of Ackawoi children in Guiana, mentioning a boy who amused himself by catching a sand-wasp and tying to it one end of a fine long hair. To the other end of the hair he fastened a bright-colored flower, and letting the insect go, chased it, sufficiently flower-burdened to prevent its escape. Mr. Murdock tells an interesting story of a little Pt. Barrow Eskimo who amused himself with an aboriginal bean shooter, consisting of a piece of whalebone about three inches long. Having provided himself with some fine round pebbles, he would call upon a bystander to look at something in the distance; then, as quick as a wink, he shot his victim in the head and tucked away his weapon before the latter could turn his head. Of course the wag put on a wise look, and the wounded man went to look for his tormenter. The same whalebone ballista had on the other end a series of sharp teeth with which the wag would tear out a bunch of hair from a deer-skin robe. The Indian boys of Guiana imitate the animals at their sports, play sun and moon, and are skillful in plaiting flower wreaths.

Ancient Commerce.—Miss Buckland has been studying the evidence of ancient commerce to be gathered from certain gold ornaments which are found in Cornwall, in Ireland, and in Etruria and Greece; and in the Journal of the Anthropological Institute

(XIV, 3–13) seeks to trace out when and by what means this intercourse took place. Miss Buckland discards the theory of similar forms arising naturally out of similar grades of culture, and holds that like complex forms of any kind show intercourse carried on by means little known and understood, but which is indicated alike by language, by manners and customs, by variations of race type, by traditions, and lastly by relics widely distributed, yet evidently the work of the same people.

THE FIJIAN NANGA CUSTOM was practiced by certain tribes of Naviti Lovu in the ceremony of initiation. The Nanga is an oblong, rectangular enclosure, fenced with stones set edgewise in the ground. Two partition walls divide the space into three parts: The Sacred Nanga, in which the kava bowl stands; the Great Nanga, and Little Nanga. Low places in the partition walls, easily stepped over, afforded access from one part to another. A bell-roofed house or temple stands just outside of the Nanga tambu tambu, or Sacred Nanga. These compartments of the Nanga were for the elders, those who have attended two ceremonies, and the probationers, respectively. Whenever the elders judged that there was a sufficient number of youths ready for admission, a Nanga was held. While, as a general rule, the young men were eligible for admission at about the age of puberty, some passed their majority before initiation. Vast quantities of food and clothing were accumulated for the occasion, and every part of the Nanga swept and garnished. The heads of the novices were shaved with a shark's tooth or shell, assisted by a fire-stick. Long rolls of tapa were wound around their bodies. Four days were spent alternately in offerings by the novices and in feasting. On the fifth day the novices were taken to the sacred enclosure, and after mysteries were performed, were declared members of the Nanga. On the sixth morning the women enter the Nanga and great license prevails. The ceremony of initiation closes with a bath. No painful treatment of the novices seems to have taken place further than attempts to terrify them. In the Nangas took place also the rites of sacrifice, thank offering and circumcision, the latter being accompanied by the most horrible license and the suspension of proprietary rights.—*Rev. Lorimer Fison, J. Anthrop. Inst., xiv, 14–30.*

MELANESIA.—The Rev. R. H. Codrington has been enlightening the Anthropological Institute of London upon the languages of Melanesia, including New Caledonia and Loyalty, New Hebrides, Banks and Torres islands, Fiji, Santa Cruz and the Reef islands, and Solomon islands. The drift of Mr. Codrington's theory is that the tongues of Melanesia are homogeneous, of one common stock, and this stock is the same to which the other ocean languages belong: Malayan, Polynesian, the languages of the islands that connect Melanesia with the Indian archipelago,

and Malagasy. This view is opposed to the theory that the original Melanesian stock is distinct from that to which the Malay and Polynesian belong. Dr. Tylor seems to fall in with this view, since he says: "The Melanesian and Polynesian languages are of one family, but the Melanesian preserves earlier and more perfect forms, the Polynesian being a group of much broken down and comparatively modern dialects spread recently by emigrants." On the other hand Professor Keane suggested that if Mr. Codrington is correct in assuming the original unity of Malayo-Polynesian and Melanesian speech, all our conclusions regarding the relative value of physical and linguistic types will have to be reconsidered. The theory of Mr. Codrington is that of the elder Von der Gabelentz; but the younger (George) Von der Gabelentz and Dr. A. B. Meyer recognize in their "Beiträge zur Kenntniss der Melanesischen, Mikronesischen, und Papuanischen Sprachen" (Leipzig, 1882), the presence of at least two organic linguistic elements, a Melanesian or Papuan, and a Malayo-Polynesian in the Oceanic world.

ARCHÆOLOGICAL FRAUDS.—The NATURALIST for some years has strenuously and continuously warned archæological collectors against giving factitious values to relics. It is this craze to have more and prettier stone implements than his neighbor that leads the rich collector to put a higher value upon specimens than they merit. In the first number of Revue d'Ethnographie for 1884, Dr. Charles Rau, Curator of Antiquities in the National Museum at Washington, publishes a statement over his signature that the collections of M. S. Valentine, exhibited and applauded in many cities of Europe two years ago, are frauds. Dr. Rau adds that he discredited the specimens when they were in Washington, but had no proof against them save his own opinion. The case is now changed, and the men who made Valentine's objects have actually produced a duplicate set for the Smithsonian, and they are deposited in the National Museum.

MICROSCOPY.[1]

SOME LABORATORY APPLIANCES.—1. *Water-bath apparatus for paraffine.*—The laboratory appliances for the use of students and others engaged in work requiring the employment of imbedding processes will, of necessity, vary considerably with the judgment and taste of those concerned.

The apparatus in use for some time past in the embryological laboratory of the Mus. Comp. Zoöl. at Harvard College, may offer suggestions to those who contemplate fitting up laboratories for such purposes.

There are many advantages in having a water-bath for each person instead of a common tank for all the students in a lab-

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoölogy, Cambridge, Mass.

oratory. The outlay is somewhat greater at first, and the increased consumption of gas makes the expense still more, but both are more than counterbalanced by the advantages of having all one's materials close at hand, and of being free from the unavoidable interference incident to the use of common property.

The water-bath employed is that which was introduced by Paul Mayer[1] at the Naples Zoölogical Station, with slight modifications which will be described below.

The operations are more conveniently managed if the top of the water-bath is nearly on a level with the top of the work-table. If it is supported on a tripod standing on the table, it is too high to be easily watched, and cuts off light from the table unnecessarily. It is easier as well as safer to adjust the distance between the bottom of the water-bath and the gas jet by making the latter rather than the former movable.

These considerations have led to the adoption of the following arrangement. The bath is supported (Fig. 1) on a wrought-iron bracket of the form indicated in Fig. 1 *b*, firmly screwed to the end "bed-piece" of the work-table in such a position as to leave twenty-five or thirty millimeters space between the front edge of the table and the water-bath, the top and end of which are respectively even with the top and end of of the table. The bath is thus practically at one's elbow without interfering with the ordinary operations.

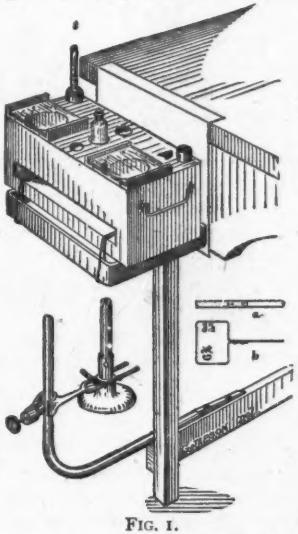


FIG. 1.

The bracket is made of heavy band iron, about 25×3^{mm}, bent into a rectangular form (Fig. 1 *b*) a little shorter than the bath, and securely riveted, as shown in the cut. A piece of sheet iron of the size of the bottom of the water-bath is placed under it as a guard, from which any accumulation of soot may be readily removed. The bath resting on the guard is secured against accidental displacement by passing, at each end, a copper wire through the oven in the bath and winding it securely around the bracket.

The gas burner is carried by a fork support which clamps to a 12^{mm} round iron, and may therefore be readily adjusted to any desired distance from the bath. The rod is bent at right angles

[1] AM. NAT., Vol. XVI, p. 785, Oct., 1882.

and screwed to a cross-piece connecting the legs of the table near the floor. The tubing leading from the gas pipe at the wall is not shown in the figure. The stop-cock in the gas pipe should be within easy reach of one sitting at the table.

Lest the heat of the gas flame should char the table in the vicinity, a sheet of zinc is tacked to the *under* side (not to the upper side, as shown in the figure) of the table top.

The paraffine water-bath, of which Fig. 2 gives a truthful representation, is made of tin-lined burnished copper, is about 18^{cm} long, 9^{cm} broad and 8^{cm} high, and has an oven near the bottom for warming slides. The oven is 1^{cm} high and 12^{cm} long. The single cylinder soldered to one end of the Naples bath to serve

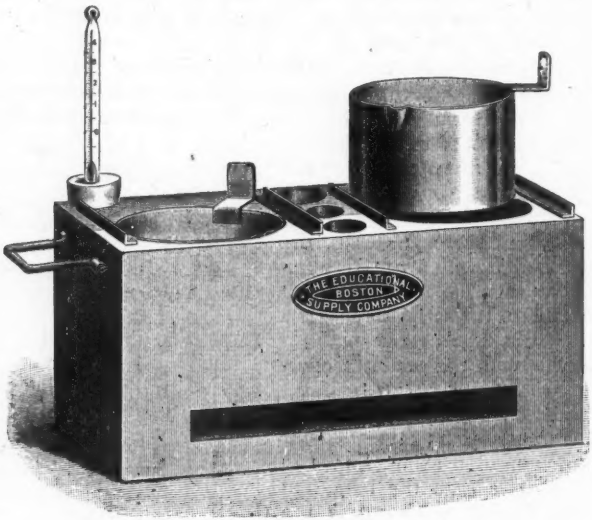


FIG. 2.

as a handle, has been replaced by a strong brass wire handle at each end. When not in use the handles are turned down out of the way. The water space communicates with the outside through only one opening, the "chimney," which is shorter (12^{cm}) than in the Naples form. The whole is therefore more compact and may be more readily packed for transportation to the sea-side or elsewhere.

There are two large and four smaller copper-lined wells in the top. All but one of these are 4^{cm} deep, the remaining one, in the corner, is 7^{cm} deep. The two larger wells are 6^{cm} in diameter and receive each a copper tank, one for soft, the other for hard paraffine. Each is provided with a firm brass handle bent at

right angles, the horizontal arm being from the lip of the tank about 12^{cm} long; the perpendicular arm is of about the same length. The nose for pouring out the paraffine is so fashioned, by reëntrant folds of the lip on either side of it, that it does not necessitate a "well" larger than the tank; the latter therefore fits snugly in the well.

But in imbedding ordinarily small objects, it is quite unnecessary to remove the tank. It is much more convenient to *dip* the melted paraffine into the mold by means of a metallic ladle previously heated for an instant in the flame of an alcohol lamp. The silver-plated deep-bowl "mustard spoons" of the shops answer the purpose admirably and are inexpensive. On either side of the two large wells copper ledges are soldered for the support of a glass plate which protects the paraffine from dust and is prevented from displacement by the chimney (or the thermometer) at one end, and the handle of the cup at the other (Fig. 2). The ledge is from one to two millimeters thick, and thus allows room for the handles of as many ladles as one wishes to keep immersed in the melted paraffine.

These ladles, which are almost indispensable, are readily fashioned out of *soft* copper wire of from one to two millimeters diameter. If the wire is thicker it can be flattened where it emerges from the tank under the glass cover. The wire, cut to the proper length, should have one end evenly rounded with the file. The rounded end is then to be beaten on a smooth anvil by light, rapid taps with a *smooth*-faced hammer until it is broad and thin. If carefully done the wire will have an even, bright surface,[1] and then may be easily fashioned into a trough- or spoon-shaped ladle by gradually indenting one side by rubbing it with the blunt, rounded, polished end of some hard object while it rests upon a piece of soft pine or cork. The ladle once formed, the wire serves as a handle, and may be bent in any desired manner.

It is very desirable that the object to be imbedded, especially if small, should not be allowed to rest on the bottom of the tank, since with the greatest care there will always be more or less sediment,[2] and since it also is difficult to raise delicate objects

[1] Spatulæ for transferring sections and small objects are quickly made in the same way, and may be sufficiently silvered by being dipped first in weak nitric acid and then in a one per cent aq. sol. of silver nitrate. When dry, polish. Repeat the silver bath if necessary.

[2] The most satisfactory way of removing sediment is to allow the bath to cool very gradually to the congealing point of the paraffine, in order to allow the impurities to settle completely, and when quite cold to remove the tank and heat it quickly all over in the flame of a spirit lamp. The paraffine in immediate contact with the tank is thus quickly melted without softening the whole cake, which may then be removed (upon the end of a stout needle thrust into it obliquely) and cleaned by paring off as much of the bottom as is discolored. Before returning the cake to the tank, the latter should be again heated, and while still hot the remnant of paraffine attached to its sides should be removed by thoroughly rubbing the inside of the tank with a piece of clean paper, which is less liable to leave lint behind than a cloth would be.

when once they are allowed to rest upon the bottom. For these reasons ladles to support the objects are very serviceable. If plated with silver or nickel, the smaller objects are more readily distinguishable. If the bowl of the ladle is allowed to rest upon the bottom of the tank, it is more liable to become contaminated by the sediment than if it is suspended a little above the bottom. There is also greater danger of overheating the object, when the bath is quickly heated up, if the ladle is in contact with the bottom. The copper-wire ladles may be easily suspended by giving the portion which projects above the edge of the tank the proper curves. The simplest way is to turn the wire into a flat spiral of three or four turns, leaving the terminal ten or twelve millimeters to project from the center of the coil as a handle perpendicular to the plane of the spiral. If sufficient distance is left between the coil and the edge of the tank, the weight of the coil will overbalance the weight of the obliquely placed ladle end of the wire, and the latter may be made to occupy any depth in the paraffine by slightly altering the angle which the wire makes at the lip of the tank (Fig. 3).

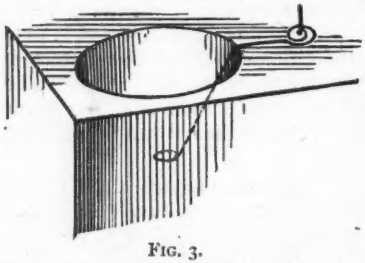


FIG. 3.

Of the smaller wells three, including the deeper one at the corner, are eighteen millimeters in diameter, and are designed to accommodate two-drachm "homœopathic vials." The corner well may be used for a thermometer or, if it be preferred to insert the latter directly into the water through the chimney, for a longer vial. The fourth of the smaller wells has a diameter of twenty-four millimeters, and is intended for a mercurial gas regulator or for a larger vial, as occasion requires. It occupies the side toward the table in Fig. 1, where it is represented too small.

This paraffine water-bath, including the two copper tanks and a short thermometer (0°–100° C.), is to be had of the Educational Supply Co., No. 6 Hamilton place, Boston, Mass., for $8.00; without the thermometer for $6.50.

2. Orienting Larger Objects in Paraffine.—In imbedding smaller objects the orientation is facilitated by employing some such instrument as Zeiss's dissecting microscope, but for larger objects a simpler contrivance answers every purpose. The glass plate upon which the imbedding is to be performed is placed on top of an ordinary glass dish—5^{cm} deep and 10^{cm} in diameter is a convenient size—at the bottom of which a small mirror is so adjusted as to make an angle of a little less than 45° with the horizon. With the mirror turned toward the window the light

traversing the sides of the dish is reflected upward, and renders the outlines of the object sufficiently distinct for most purposes of orientation.

3. Dissecting Pans.—The most satisfactory material for the "filling" to dissecting pans is undoubtedly bees-wax, and for ordinary purposes it should be made black by having *thoroughly* stirred into it while melted a quantity of lamp-black. This mass, "run" into suitably-shaped tin pans—provided with narrow ledges soldered to the inside just below the prospective surface of the wax, to prevent its floating in the dissecting fluid—is serviceable for a time, but is destined sooner or later to become worthless, owing to the inevitable rusting of the pan. Fortunately there have come into the market, within a year or two, heavy glass dishes (they are of various proportions) with short legs at the four corners, which are suitable in shape for dissecting pans. They present the advantages of admitting more light upon the object and of not rusting. The wax may be prevented from floating in the dissecting fluid by pouring into the melted wax in the dish a sufficient quantity of shot to give the desired specific gravity to the whole mass. Since these dishes are apparently cast in molds and are presumably not of the best quality of glass, some care should be used to prevent breakage. This can be readily accomplished by floating the glass dish in a pan of water, and gradually raising the temperature of the water to near the boiling point. The hot wax then poured into the glass will not be likely to break it. A convenient size, 25^{cm} by 15^{cm} and about 5^{cm} deep, retails for about forty cents, and can probably be had from most of the glass dealers. Mr. M. G. Cochrane, of Clark, Adams & Clark, 65 Franklin street, Boston, can supply them.

When the surface of the wax has become impaired, it may be restored either by remelting the whole or, more quickly, by directing the flame from a gas burner downward upon the surface, whereby enough can be melted to accomplish the object.

Dissecting-trays of various shapes to suit special objects may be made by excavating thick blocks of the wax, or by sawing out from a thick board with a fret-saw a piece of the desired shape. A thin board nailed over one side of the hole thus made, forms the bottom of the tray. This is to be partially filled with the melted wax, which may be made to coat the sides of the tray to any desired thickness by simply tilting the tray while the wax is in a fluid condition. Any irregularities may be repaired by careful use of the gas jet.—*E. L. Mark, Mus. Comp. Zoöl., Cambridge.*

SCIENTIFIC NEWS.[1]

— The commemoration of the Heidelberg University semi-millenial leads the London Times to a comparison of the ages of the several German-speaking universities. The oldest is Prague, founded in 1348; next comes Vienna, founded in 1365; Heidelberg follows, being the senior of the universities in the German empire, founded in 1386; then Leipsic, in 1409; Freiburg (Baden), in 1454; Greifswald, in 1456; Bâle, in 1460; Munich, in 1472; Tübingen, in 1477; Marburg, in 1527; Königsberg, in 1544; Jena, in 1558; Würzburg, in 1582; Giessen, in 1607; Kiel, in 1665; Halle, in 1694; Breslau, in 1702; Göttingen, in 1737; Erlangen, in 1743; Berlin, in 1810; Bonn, in 1818; Zürich, in 1838; Berne, in 1834; Strasburg, reëstablished in 1872, originally founded in 1567.

— The honorary degree of Ph D. has been conferred by the University of Heidelberg, Germany, upon Alexander Graham Bell, of Washington; Professor Edward D. Cope, of Philadelphia; Professor Othniel Charles Marsh, of New Haven; Professor Simon Newcomb, superintendent of the Nautical Almanac at Washington, and John W. Powell, director of the Geological Survey.

——:o:——

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

PHILADELPHIA ACADEMY NATURAL SCIENCES, March 2, 1886.— Professor W. K. Brooks, of Baltimore, spoke upon the development of Podocoryne. The planula settles upon and spreads over the carapace of a hermit crab. Two hundred to three hundred hydras, like fresh-water hydras, differentiated as feeding polyps, are developed. Another form of hydra, with short tentacles packed with poisonous lasso-cells, is produced next in order. Then follow the blastostyles, which neither take food nor are defensive, but are the seat of the medusa buds, which increase until they are larger than the entire hydroid community to which they belong, and are ultimately set free. In Podocoryne these medusæ are not the ultimate sexual form, but produce buds which are set free, develop reproductive elements and reproduce the planula stage. The crops are all male or all female. In the Geryonidæ a single egg becomes a single sexual individual, but passes through the planula and hydroid stages, which are true embryonic states. The Cunina larval colony which infests the jelly-fish, Turritopsis, ultimately develops into medusæ without alternation of generations; but another species of Cunina, the history of which has been traced by a Russian embryologist, remains a budding stolon, from which other hydras are produced. Professor Brooks believes that alternation of generations, viewed in the

[1] Edited by WM. HOSEA BALLOU, 265 Broadway, New York.

light of these and other facts, does not arise from polymorphism, but from the power of the larva to develop asexually.

April 10.—Professor Heilprin gave an account of his collecting tour in Florida. Miocene strata were found at Rocky Bluff on the Big Manatee river. The rocks on both sides of the Caloosahatchie, until within fifteen miles of Lake Ochechobee, are literally crammed with fossils. The bottom of the lake consists of hard, clean sand. Eight or nine kinds of mollusks, two of fishes and a few annelids and crustaceans were all the fauna found in the lake. Vast wind-rows of dead fishes were found upon the seashore, owing to the severity of the winter.

Mr. Potts stated that in a collection of fresh-water sponges from Avalon, Newfoundland, made by Mr. A. H. McKay, he had found several new species of four or five genera. One species has both spindle-shaped and birotulate spicules, thus uniting two groups.

May 4.—Professor Heilprin described two human vertebræ from Sarasota bay, Florida. The bones, imbedded in ferruginous sandstone, had become converted into limonite. The cavity which once contained the head could be traced, and the head was known to have been present not many years before. The deposit was probably post-Pliocene, yet of great antiquity.

Mr. A. H. Smith referred to a log of hemlock that had been obtained, during railway excavations, at a depth of thirty feet from the surface in black earth which had once formed the bed of the Delaware.

May 11.—Professor Heilprin showed that Professor Le Conte's previous views regarding Florida were based upon an incorrect reading of the published researches of the State geologist of Alabama.

Dr. Leidy read a communication from Dr. Gonzalez, of Durango, Mexico, giving an account of the fatal effects which invariably follow the sting of the scorpion of that place, and asking for a mode of treatment, since all antidotes yet tried had failed.

Dr. Leidy read an account given by Mr. E. A. Rau, of Bethlehem, of a case of trichiniasis which resulted in the poisoning of a whole family and the death of the mother and a daughter. The pork eaten was home-raised, and the animal showed no sign of ill health. The meat was imperfectly cooked and had been fed upon for a week.

June 7.—Mr. Meehan exhibited a fasciated branch of a cherry with 400 branchlets, where there would normally be no more than twenty. A fungus, *Exoascus wilsneri*, allied to that which produces the curl in peach leaves, seems to be the cause of the growth.

Mr. J. Ford reported the occurrence of *Modiola tulipa* at Cape May and Anglesea. There is no previous record of this mollusk

north of South Carolina. Mr. U. C. Smith reported *Pholas truncata*, another mollusk new to the locality, from Anglesea.

Dr. Leidy exhibited fossils from the northern part of Nicaragua, consisting of remains of megatherium, elephant, mastodon, horse, ox, toxodon and capybara. The association of animals further illustrated the extension in North America of the South American Quaternary fauna. The capybara jaw, more robust than that of the recent form, might belong to a distinct species. It was the first time that remains of toxodon had been obtained in North America. The teeth agreed with those of *Toxodon Burmeisteri.*

June 8.—Dr. Benjamin Sharp reported that while studying the eyes of serpents he had found that in the poisonous snakes the pupils were elliptical, while in the harmless species they were circular. The only exception he was aware of was in the Elapidæ.[1]

The same speaker also stated that he had found that the reason that only the anterior face of the crystalline lens moves in the act of accommodation to distance, lies in the fact that upon pressure the elongated cells of the posterior wall of the lens become compressed in the direction of their long axis, and when the pressure is removed these simply straighten out.

Dr. Foote described the mines of Queretaro, noted for the quantity and quality of the precious stones yielded by them. Opal has been found in varying quantity over the entire area of a district twenty-five leagues by six. In color the opals equal the best Hungarian opal.

Professor Heilprin called attention to the fact that specimens of *Nassa obsoleta* and *Littorina saxatilis*, collected at Atlantic City a year ago, were stated by the lady who gathered them to be still alive, though for several months they had been near a heated wall surface.

Dr. H. Allen stated that in no case could muscles be properly said to be *fused.* The biceps of the cat simply overgrows the space originally allotted to it, and takes advantage of an adventitious surface of insertion. The pectoralis of man is composed of a single sheet folded on itself.

Dr. C. S. Dolley read a paper on Salpa.

June 24. Mr. Meehan described the Japanese oak, *Quercus dentata*, one specimen of which he succeeded in raising ten years ago. It was now eighteen feet high, and probably the only example in America.

Dr. W. P. Gibbons, of Alameda, Cal., spoke of the viviparous Embiotocidæ.

[1] [It is known that many non-venomous snakes possess vertical slit-like pupils, while nearly all the venomous serpents of the sub-order Proteroglypha have the pupil round.—*Ed.*]